THE ART OF COLOUR

BY

MICHEL JACOBS

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AUTUMN LEAVES AND FLOWERS — By MICHEL JACOBS

In Split Complementaries

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THE SOURCE

God in His infinite goodness
Gave us the light of the sun
Whether it shines bright in the heavens,
Or scatters its light through a cloud,
Or the moon sends back its reflection,
Or the sunbeam enters the home.
Wherever there's light there's colour;
For black is the colour of blindness
And a total absence of light.

M. J.

FOREWORD

HE Art of Colour" is not a scientific book but is based on scientific knowledge. Only less than one tenth of the spectrum is visible to the human eye, but the artist or craftsman is interested only in the effect of the visible rays; on the other hand, a scientist is interested in knowing both the visible and invisible rays which he records with instruments.

MICHEL JACOBS.

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INTRODUCTION

HIS book is designed as a work of reference as well as an attempt to present a "system" rather than a "theory" for teaching the art of colour. The writer's articles on "Colour" were published in the Montreal *Star* in August, 1913, and in the *International Studio Magazine* in April, 1916, followed by another discussion in the latter magazine for November, 1919. During the three years previous to 1913, this system was taught by the author in art classes. Although at that time it had not been elaborated, the underlying theory was the same as that to be presented in the following pages, and to-day many painters are using it in their work.

In the various chapters reference is made to the multifold application of this colour system, which it is hoped will prove of value and interest both to the student and to the layman, and helpful to the artist, the craftsman, and the layman in solving problems encountered both in effecting combinations of colour and in the mixing of paints.

Art may be said to be nature seen through a personality, and personality is a product of information plus observation. But everyone does not see nature in the same way, and it is the duty of the artist to depict things as he sees them. It follows that as some people do not possess the quintessential artistic sense their ideas about nature are not of as much artistic significance as are the conceptions of others. There are many who conceive mere photographic likeness to be "art"—that the mere delineation of detail constitutes artistic expression. But, it must be known to most of us, a camera does not see as comprehensively as the human eye, and that even with the wonderful conquests of colour photography mere mechano-chemical reproduction falls far short of nature's marvels in picture.

Neither colour nor the combination of colours alone is art. We must have some form to express that which we wish to portray. Combinations of colours giving us a sense of exhilaration or depression are enhanced and made worth while by the delineation of form at the same time. An effort will be made to show in these pages the psychological effect of colour combinations. The colour theories of Helmholtz and Tyndall are taken for scientific bases.

To say that a particular thing "pleases" is not to say that it is artistic. There is a right and a wrong in colour combinations as there is harmony and discord in music. It is not always necessary to make combinations of brilliant colours to be a colourist, for very often the combinations of grayed or neutralized tones are more satisfying. It often happens that while a particular form of art

is unintelligible to one individual he may be able to express his personality in some other form.

Because some of the sixteenth and eighteenth century masters painted in dark, often brown tones, there is no reason why we should follow their example. We usually compare one picture with another instead of with nature. It must be understood that each of the old masters is known for a special virtue in artistic achievement. Michelangelo is known for his wonderful strength and his marvellous conceptions; Leonardo da Vinci for facial expression; Raphael for his ideal inspirations; Velasquez for his aristocratic figures bathed in light and his exquisite silvery grays; Rubens for the quality of his flesh tones and the colour of his wonderful draperies; Van Dyck for his delineation of culture in portraiture; Rembrandt for his beautiful light and shade and golden tonalities; Franz Hals for his extraordinary draughtsmanship, brushwork, and facial expression.

It is a mistake to compare modern pictures with old masters. None of the old masters was able to paint sunlight in "plein air." Leonardo da Vinci himself tells us that to look like sunlight a picture must be displayed in sunlight. To-day we know that by the help of modern science it is possible to paint a picture so that, though displayed indoors, it gives the impression of sunlight in "plein air." The painter is never justified in producing a flamboyant combination of brilliant colour without taste.

In these chapters the author has endeavoured to take up a few of the many applications to which this colour system can be adapted, and it is believed that the book will be of use not only to the portrait painter, the architect, and the landscape painter, but to poster and commercial artists, interior decorators, costume designers, landscape gardeners, colour psychologists, house painters, colour printers, stage designers. The principles set forth are equally applicable in glass staining, pottery and other ceramics, in batik and fabric dyeing; in the weaving of fabrics and the designing of wall paper, and perhaps it can be adapted for colour therapeutics and music in relation to colour.

The writer wishes to thank those of his pupils who have helped him in the painting of the many exercises in this book, and particularly William Bond, Charlotte Bristow, Maude Kemper, Lloyd Coe, Helen DeLamater, Herbert Friedemann, Phillips Melville, Nancy C. Wotton, James Scott, and Frederica Thomson.

In addition, I wish to thank Miss Emilie Sarter, and my secretary, Miss Edith Bell, who have typed and re-typed this book many times.

THE ART OF COLOUR

CHAPTER ONE: COLOUR THEORY*

IN THESE days of technical knowledge and scientific accuracy, it is a great wonder that the artist still follows the old law of colours and their complementaries as demonstrated by Newton and Brewster, based on the theory that red, blue, and yellow are primary colours, and green, purple, and orange are secondary. This theory has long since been discarded by scientists and the new theory adopted as laid down by Young-Helmholtz-Tyndall, that the primary colours are red, green, and violet. The difference between these two theories is that the Newton-Brewster theory is based on the mixture of pigments and the Young-Helmholtz-Tyndall on the spectrum.

When we see an object that is a certain colour in a white light the shadows of that object assume a colour that is toward the complementary to the colour of the lighted side, as Monet discovered. All modern artists understand this. The question is: what is a particular colour's complementary? By complementary colour we mean that one of the primaries is complementary to the other two primaries combined. Now, should we use the old theory of Newton, or that of Helmholtz which is based on scientific truth?

It is true to a certain extent that we cannot mix red and green pigments and make a yellow, but with the rays of light it is possible to combine the red rays with the green and secure a brilliant yellow. Also we may combine green with a violet light and make a brilliant blue, and so forth.

Why painters should change the laws of colour as seen in the spectrum and their complementaries because the chemical properties of the pigments on their palette do not mix as do the rays of light, one fails to understand, although it is possible with certain chemicals to follow exactly the laws of the spectrum.

To repeat, Art is nature seen through a personality. If it is the desire of the artist to imitate nature as closely as possible, at least in regard to colour, he must be conversant with *all of nature's laws of colour.* Undoubtedly if an artist tries to paint scientifically and does not really see the colours which he paints, his work will be of no use from an artistic standpoint. But he must be taught to see colour as he has been taught to see form.

Nature has given us in our eyes three sets of nerves corresponding to the colours of the spectrum. One set of nerves is sensitive to green rays, one to red, and one to violet. If the violet and green nerves are set in vibration we see, not green and violet separately, but blue, and if the green and red are set in vibration we see yellow, and so forth.

*First published in 1913.

Let us see what difference it makes whether we take as our guide the spectrum, or our palette, which to me is only a chemical laboratory from which we make combinations of chemicals to reflect certain colours of the spectrum. Suppose, for example, we are painting a red object. According to the law of the spectrum the shadow of that object should be toward the blue, because blue in the spectrum is composed of the green and violet rays of light and must be complementary to the third primary, red. According to the laws of pigments, as laid down by Newton-Brewster, the shadows of a red object should be toward the green, because green is composed of yellow and blue pigments and must be complementary to the third primary, red, as Monet set forth.

To arrive at an understanding of complementaries, let us say that the spectrum is represented by 100 which is divided into three equal parts: red, green, and violet, each represented by 33⅓% of the whole of the spectrum. Suppose we take, for example, a full yellow which is composed of all the red rays (33⅓%) and all the green rays (33⅓%), which means that yellow is 66⅔% of the spectrum. Now the complementary must be a colour that has 33⅓% of the spectrum to make up the whole 100%. We find this to be violet.

But let us take an orange which is composed of all the red rays (33⅓%) of the spectrum and only 16⅔ of the green rays, which together would be 50% of the spectrum. To find the complementary we must make up the 100% by taking all of the violet rays (33⅓%) and 16⅔% of the green rays, making a blue which is 50% of the spectrum. This blue would be a violet blue or ultramarine, so that ultramarine is complementary to orange formed of all the red rays and 16⅔% green rays, making the full spectrum or 100%.

This applies to the light of the sun; but it must be understood that other light has not the same even proportion of coloured rays. In fact, some lights have very little violet rays, such, for example, as ordinary gaslight, which fails to show a true blue on account of its having more of the green and red rays and only 8% of the violet rays.

The complementaries of the spectrum, according to all modern scientists, are as follows:

Red is complementary to blue (not to green as in pigments)
Crimson to green (not yellow-green)
Violet to yellow (not to orange)

It will be noticed by the chart (see Plate I) that these complementaries are interchangeable, and if the colours used in pigments to represent the spectrum

are as follows, it will be found that the primaries of the pigments are made by the secondaries of the spectrum: i.e.,

Primaries:	
Red	French vermilion
Green	Emerald green
Violet	Cobalt violet with ultramarine
Secondaries:	
Yellow	Lemon yellow or pale cadmium
Blue	Light ultramarine (W. & N.) or cobalt blue
Crimson	Alizarin crimson
Intermediate Hues:	
Orange	Chrome orange, deep or orange cadmium
Yellow-green	Émeraude with zinc yellow
Blue-green	Émeraude with blue
Blue-violet	Dark ultramarine
Purple	Cobalt violet with crimson
Scarlet	Harrison red

Thus we have all the primaries of the spectrum, the secondaries and one shade between each. Of course, I would not advise any painter to use such pigments as emerald green or French vermilion, especially when mixing with lead white, but both of these colours can be imitated very nearly by the admixture for the red vermilion of alizarin crimson and zinc or lemon yellow, and for the green, not quite so well, with émeraude green and zinc yellow, or better still cerulean blue, zinc yellow, and zinc white. Even those two fugitive colours, vermilion and emerald green, can be used pure when mixed with a little varnish, if an extra brilliant spot of colour is required.

After a great deal of experimenting one comes to the conclusion that a picture, to be a true representation of nature, must be painted according to the laws of the spectrum, using the law of pigments to represent these colours, and one finds that when he is painting an object which, we will say, is yellow in a white light, it is best to break into it with green and red, because yellow in the spectrum is composed of red and green rays. The shadow should be toward the violet, because violet is the complementary of yellow. I find it possible to paint blue with green and violet if the colours are kept separate after the manner of the pointelle.

In regard to the so-called tricendary colours, I would call these grays of

different hues, because in making tricendaries we must mix the three colours of the spectrum. For example, mixing orange with blue would give us a neutralized green which is now called a tricendary colour. The spectrum has no gray or neutralized tone in its composition but it is one mass of pure colour which when combined in the correct proportion gives us white.

If we look at the chart (Plate I) we shall see that it is a very easy matter to tell which is the complementary of any colour by simply drawing a line directly through to the colour opposite. For instance, violet is complementary to yellow and red to blue, etc.

If one divides the chart in half, all on one side of it will be found by the combination of these colours to be in tone; that is, if all of the colours are used on one half of the spectrum (no matter which half of the spectrum is used) they will be harmonious. For example, red, orange, yellow, yellow-green, green and blue-green would make a harmony; while blue, blue-violet, violet, purple, crimson, scarlet would make another harmony. To get a complementary, let me repeat, take the colour directly opposite—red and blue, violet and yellow, crimson and green.

I do not profess to have discovered a new theory nor do I presume to teach a great many painters more proficient in the art than myself, but I have devised a way to use the new theory of colour of Young-Helmholtz in the art of painting. It must not be inferred that I maintain that at all times and in all pictures the most brilliant colour should be used for I am well aware that the most restful tones are those grouped as the grays—blue-gray, green-gray, etc. Nor can one object to a picture because it is painted in browns; only one must accept such a canvas not as a true representation of nature but as a study in brown with a little colour, just as one may draw in black and white and tint with colour. It will be seen that any colour, even the brown, must partake of and lose itself in the atmosphere and change its hue.

CHAPTER TWO: COLOUR FIRST—FOR ART STUDENTS

INCE the Italian Renaissance the student of painting has been taught first to draw—sometimes for many years—and when, at last, he is allowed to use colour he must start to learn his medium over again. It would seem more practical to teach colour first—in all its ramifications—and then, when the student really understands his medium, teach him to draw, with one colour if necessary.

In this way the mind of the student is kept full of the enthusiasm with which he at first takes up the study of art—this enthusiasm which is so essential to make a real artist and without which he becomes a mere craftsman. An appreciation of colour is the first instinct of a child and of a savage. How often have we seen students whose drawing was very strong in form and value but who, when they took up pigment, could do nothing with it, much less achieve a brilliant effect. They do not understand their medium; they do not understand the effect of *light on colour.*

The eye soon becomes accustomed to seeing objects in black-and-white values, and unless this is corrected by continuous exercises in colour, to bring the eye back to its natural perception, the student will be able to illustrate only without colour. Many an illustrator knows the truth of this assertion to his sorrow, but let me say to these that with proper instruction it is possible to make brilliant colourists of those who are willing to go through a course of instruction and training.

Since the days of the "Brown Sauce" school, many artists have really seen and painted colour *in spite* of their academic training of seeing things in black-and-white values. This is because they have a natural colour sense and because they have seen the truth in the "Saner Revolutionists." But how many more are there who want to paint in brilliant hues, who want to put the wonderful effect of sunlight on their canvases yet who cannot see nature as she really is? This applies to those artists who paint indoors as well as to those who paint "plein air"; for there is just as much to know about colour in the studio as in the open. All shadows are not simply "darker" or "lighter" in value, they must change their colour as well as tone according to the laws of colour and the natural effect on the eye.

A course of instruction should be followed which teaches the student the spectrum first, getting his eye accustomed to seeing brilliant colour. Then he should be taught how to mix pigment as brilliant as is possible with modern paints, and at the same time he should be shown that it is possible to lower this

brilliancy when desired, not by the use of black, but by mixing of the complementaries.

If the true spectrum is used, all complementary pigments make a perfect neutral when mixed in equal proportions, or a neutralized colour in unequal proportions. Yellow mixed with a little violet makes a neutralized yellow, and if more violet is added it makes a more neutralized yellow, and still more violet makes a perfect neutral. By lessening the quantity of yellow, a neutralized violet is obtained, and so on, with all the other colours and their complementaries.

The student should next be taught the meaning of juxtaposition; that is, what effect one colour has when placed next to another. For example, any two brilliant colours which are complementary (one to the other) if placed side by side enhance the brilliancy of each other; but if one is neutralized the brilliant colour looks still more brilliant. Again, two complementaries against their two complementaries produce more brilliancy; or three and three; four and four; five and five; but never six and six because when these are used the whole chromatic scale is employed and the sensation of white is derived. Of course, one could use the half tones or quarter tones, but I am referring to the twelve distinct colours of the spectrum—red, orange, yellow, yellow-green, green, blue-green, blue, blue-violet, violet, purple, crimson, and scarlet.

We can make what may be called "split" complementaries, such as red and orange which together would be complementary to a common complementary.

A colour between their individual complementaries would be violet-blue or ultramarine, etc.

Harmonies are those colours which are adjacent in the spectrum, and, as in music, a colour harmony must have three tones or half tones; for example, red, orange, and yellow, or a harmony of four would be red, orange, and yellow and yellow-green. In a harmony the eye must be led to another colour. A harmony of two colours cannot exist without the tone or half tone between.

The student should be taught to look for the change in hue as well as tone in his shadows. It is a much quicker method to learn to paint. He then ceases to paint pictures with "Brown Sauce" or, the other extreme, pictures painted in the North Temperate Zone that look as if they were painted on the Equator. It is hardly pleasing to see maple trees growing under a tropical sun.

After the student has been taught how to see colour and gains the mastery of his medium, he is taught how to draw in colour—in one, if necessary—in oils, in water colours, or chalk, the last preferably, because it is the most easily handled and corrected. Then if he wishes he can use charcoal and he will love it much

more than if in the beginning he had attempted to use "the most beautiful of all mediums."

One is led to the opinion that the early masters taught their students colour while teaching them to draw, for was not the student always with the master in his studio? Did not the student paint in the draperies and minor objects in the master's picture? Did he not learn colour while mixing paints for the master? All this he must have absorbed by experience, but how much quicker could the student of to-day understand if he were taught all that science has discovered, since those days, of the laws of light and colour.

In all the arts, the laws of nature—or what science knows of them—must be taught to the student, and these laws must become a part of his being. He must be able to use these laws without thought. A man cannot fence unless his sword is a part of himself.

There are those artists who say colour "must be felt." They are right, in a sense, but we must be taught how to feel, just as we were taught to see form in drawing in the beginning of our student days. The individuality will come after we understand nature. No two men draw alike, yet many were taught to draw in exactly the same way.

CHAPTER THREE: COLOUR-MIXING— HUES, TINTS, TONES, AND PERSPECTIVE OF COLOUR

OME time in the dim, dark ages before history began, man mixed different coloured muds with which to draw. As time went on, he found that he could make more brilliant colours by using crude chemical compounds. One colour he made of calcined animal blood and others with decomposed egg. Ultramarine was a pulverized precious stone called lapis lazuli, and greens were made from vegetable matter, etc. Later, the old masters mixed their colours by secret formulæ. Then came the artists' colourmen and to-day we have the benefit of the greatest scientific minds in chemistry to give to the artist wonderful dyes and pigments that are both permanent and brilliant.

Yet many present-day artists still mix mud as they did in prehistoric times, simply because they do not know the science of colour-mixing. They say "Colour must be felt." But the artist who handles colour in any form must know precisely what colour or tone or shade of colour he will obtain by the admixture of certain pigments. If he does not know this and mixes by experimentation he will surely make his colours uninteresting.

It is the author's intention in this chapter to show how any hue, tint, or tone can be mixed in a simple, practical way, and suggest a method whereby one can describe all colours in all their shades or tints so that the student can understand the master. It is entirely feasible to describe a colour clearly, so that we can free ourselves from the "Tower of Babel" and talk with one another in the same colour language.

The colour-mixing charts have been so arranged that besides showing the hues, tints, and tones they can at the same time be used to show advancing and receding colours; in other words, the perspective of colour. (Plates II, III, and IV.)

All tones and tints that are on either side of the neutral form a square—four tints down and four tones across. The most neutralized colour with white is the most receding, and the brilliant colour itself is the most advancing. All tones or tints between these two points in a diagonal direction will give you the relative plane of the tone or tint. For example, O-A is the most advancing, and 3-D the most receding. The following groups are in the same plane:

3-C and 2-D
3-B, 2-C, 1-D
3-A, 2-B, 1-C, O-D
2-A, 1-B, O-C
1-A, O-B

In this way an artist can always be sure to get any colour in the same plane—when it is absolutely necessary to be accurate. The trained artist of course sees the colour without the use of a chart for this purpose.

If the colours of the spectrum are arranged in the same order as on the chart (Plate I), any colour that is opposite will be complementary. It is important that we know the *exact* colour. The simple proof in this system is *to mix the two colours together, and if they form a perfect neutral gray, they are complementary.*

The reasons why it is essential to know the exact complementary are twofold. First, the juxtaposition of proper colours (one colour placed next to its complementary) enhances the brilliancy of both. All the combinations of colours described in the following chapter are based on their relative position in the Spectrum Chart (Plate I).

The second reason is that we wish to know the exact complementary for the mixing of colours, because if we mix one colour with its complementary it will at first give us a neutralized tone of that colour, and the more we add to this complementary the more neutralized will the colour become until the two form a *perfect* neutral. In this manner, the original colour never loses its purity, but it is as if we were to have less light on that colour. While it loses in brilliancy, at the same time it keeps the exact hue throughout its entire neutralization. By adding white in larger or smaller quantities to any of these neutralized tones we produce the different tints as illustrated in Colour-Mixing Charts (Plates II and III).

When black is mixed to lower the tone of a colour, it not only changes the tone of the colour but it also changes the hue. As there is no really perfect black in pigments, all paints that are called black reflect some colour; such as blue, violet, or brown. For example, ivory black is brown-black, for if we mix ivory black with a blue we secure a neutralized yellow-green and not a blue at all. If we mix this same black with a pure yellow we get a neutralized orange, and if we mix it with a purple we get a neutralized red. If we use the colour called jet black, or lamp black, which is a blue or a violet-black, with any other colour the two will not only change in value, but will also change their hue; whereas, by the system outlined in these pages, one is always sure to retain the exact hue either in brilliant or neutralized colour without experiment. Does not this argument appeal to those of my confrères who insist that experimentation is the only means by which we can mix colour?

If one is familiar with the way to produce any hue, any shade, or any tint of colour, he will be less apt, as I have said, to make what painters call "mud."

If one can see a colour and know at once how to mix certain pigments to reproduce it, it means that there is one thing less to think about in painting a picture, in dyeing cloth, or in colour printing.

If one will but follow the foregoing directions using the Colour-Mixing Charts (Plates II and III) and the coördination as a guide he will be able to describe a colour by giving the coördinate numbers. For example, O-A is the brilliant colour; 1-Ā is the same colour neutralized one quarter by its complementary; 2-A by half neutralization, and 3-A three quarters' neutralization. O-B is the brilliant colour with white, or more water in water colour or dye; 1-B is one quarter neutralized colour with white, and so forth. It is not necessary for an artist to be so accurate in mixing colours on his palette, but if he keeps these charts in mind he will be able to analyze a colour more readily.

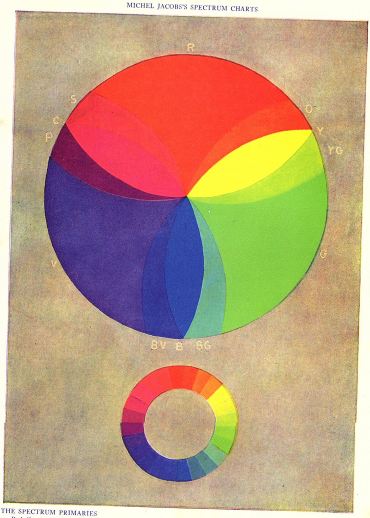
There are very many more hues than those given in the Spectrum Chart (Plate I). As already stated, the complementary can be found in Spectrum Charts 1 or 2 by taking the colour exactly opposite in the circle. The reader is again reminded that any colour mixed with another which forms a *perfect neutral* is complementary to that colour.

The painter's palette need consist of only three colours and white, namely, crimson, lemon yellow, and blue. An accurate test for these is to find a yellow which when mixed with crimson makes a perfect red (the colour of French vermilion) and if mixed with blue will make a nearly perfect emerald green; to find a crimson which when mixed with yellow will make a nearly perfect red, and when mixed with blue will make a brilliant violet; to find a blue which when mixed with yellow will make a nearly perfect green and when mixed with crimson will make a perfect violet. In this way you will make sure of having a perfect triad.

However, it is not necessary to confine oneself to just these three colours, for it is a well-known fact that the mixture of yellow and blue will only approximate emerald green and that there is no mixture that will make a perfect cobalt violet or a vermilion.

I find that the palette best adapted for my own work is: lemon yellow, pale cadmium, daffodil, or barium yellow or aureolin, yellow ochre, zinc white, alizarin crimson, cobalt violet, light ultramarine blue and émeraude green placed in this order, counter clockwise on the palette.

The artist is referred to the last chapter of this book in regard to the chemistry, relative position in the spectrum, and other data concerning each colour manufactured by artists' colourmen.



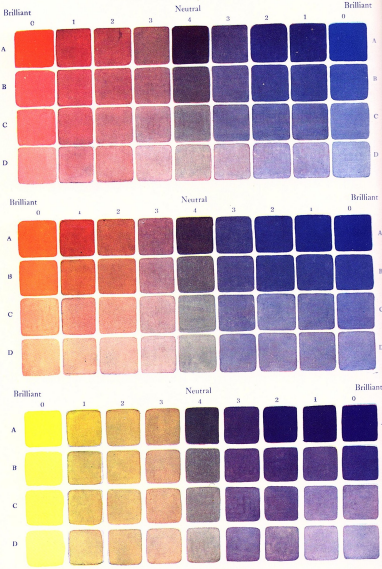
THE SPECTRUM PRIMARIES
are Red, Green, and Violet

THE PIGMENTARY PRIMARIES
are —
Crimson
Yellow and
Blue

These are also the Secondaries of the Spectrum

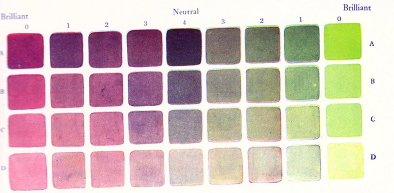
COMPLEMENTARIES

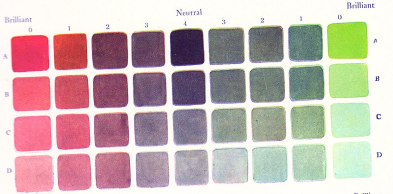
Red	Blue
Orange	Blue-Violet
Yellow	Violet
Yellow-Green	Purple
Green	Crimson
Blue-Green	Scarlet

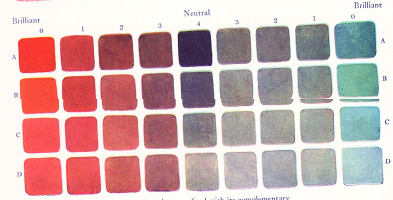


Each colour is neutralised with its complementary

PLATE II

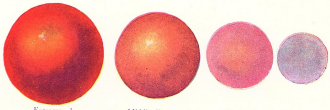






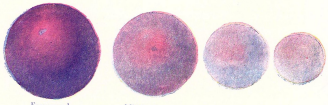
Each colour is neutralized with its complementary

Red



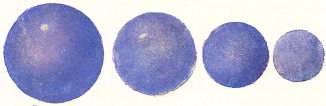
Foreground Middle distance Distance Far distance

Purple



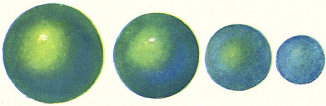
Foreground Middle distance Distance Far distance

Violet



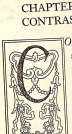
Foreground Middle distance Distance Far distance

Yellow-green



Foreground Middle distance Distance Far distance

CHAPTER FOUR: COLOUR COMBINATIONS—CONTRASTS, HARMONIES, TONALITIES, MONOCHROMES



CONTRASTS. The greatest contrast in colour is obtained by arranging complementaries in juxtaposition. Referring to Chapter I, if we put a red object next to its complementary blue, the effect on our eye will be to make both colours appear more brilliant, and if one of the colours is slightly neutralized, it will make the other colour still more brilliant. As can readily be seen, if this combination of only two colours holds good, how much more brilliancy can be obtained by arranging two colours and their complementaries together; and still more by three and their complementaries; and yet further, fours and fours; fives and fives; but to use all twelve colours of the Spectrum Chart would give a sensation of white to the eye.

All these combinations can be done in brilliant colours, neutralized dark tones, neutralized light tones, or brilliant tints, and in fact in as many shades and tones as there are in the Colour-Mixing Chart. So one can easily see that there is plenty of room to express one's personality and still be in good taste. (Plates V, VI, VII, and VIII.) Besides using all the twelve distinct colours of the spectrum, it is possible to use the hues between these colours. For example, a colour between yellow and yellow-green, a colour between green and blue-green and a colour between blue and blue-green, as in Fig. 2, which shows twenty-four colours. As I have said before, to find out if a colour is complementary, mix the two pigments together. If they form a perfect neutral they are complementary and will give the greatest contrast.

Another set of combinations which we will call "splits" is obtained by arranging colours with only one complementary. Red and orange would have a common complementary of the combined complementary of both colours, or a mixture of blue and blue-violet, which would be a blue slightly violet. Other "split" combinations would be three against one ; three against two ; four against one ; four against two ; four against three , five against one ; five against two ; five against three ; five against four ; six against one ; six against two ; six against three ; six against four ; six against five ; and of course the innumerable hues between these twenty-four colours. Thus it is apparent that the combinations of colour contrasts if followed according to this system are without number but always pleasing to the eye. (See Plates XI, XII, XIII, and XIV.)

HARMONIES. Many people confuse harmony of colour with tonal effect. The guide for harmonies, in this system, is very simple. Any set of colours within half of the Spectrum Chart is in harmony provided that at least three or less than seven distinct colours of the spectrum are used. Any hue between colours can be used as the third colour and still make a harmony; but colour, like music, needs the three steps to make a complete harmony. For example, red, orange and yellow, or red, red-orange and orange are harmonies of three. Red, orange, yellow, yellow-green is a harmony of four, etc. But if more than six distinct colours are used the complementary of one of the harmony would be included and thereby an unbalanced combination of colour would result. (See Plates IX, X.)

TONALITIES. A picture in a certain tone can be painted in two ways: by mixing one colour with all paints while painting, which is called the direct way: or by glazing afterward with a colour. In either method one must understand that the colour used to give a tonal effect will neutralize the colours which are complementary to it. If yellow is used as a tonal colour any object that is violet will be neutralized. Blue objects become green, red objects orange, crimson objects red, green objects yellow-green, yellow-green objects become more yellow, and yellow will be the most brilliant of all. This is sometimes very pleasing if not carried too far. One can see the effect that a certain tone would have on a picture and still not destroy the picture in the glazing method by taking a small piece of glass, tinting it slightly with the tonal colour decided upon, and holding it near the eye, to see the effect on the picture. Many different tones can be tried before deciding on the final tone. (See Plate XXII.)

MONOCHROMES. When only one colour is used throughout all its shades and tints it is called a monochrome. Any of the shades or tints on one side of the Colour-Mixing Chart can be used to make a monochrome. In other words, any colour which is either brilliant or neutralized or light in tint is only one colour. The neutralized tones have not the power to reflect the full colour of the spectrum rays, and the tints, having white in their mixture, reflect other rays of the spectrum. (See Plate XV.)

All these colour combinations can be combined in one picture, and the space which any one colour covers will influence the effect. For example, a picture with the foreground and middle distance painted a neutralized yellow and the distance in the complementary violet in neutralized tones and tints, would be painted in single complementaries, but the yellow would be broken up into scarlet, red, orange, yellow-green, green, blue-green; and the violet could be

One colour and one complementary—$\frac{\text{red}}{\text{blue.}}$

Two colours and two complementaries—$\frac{\text{crimson, scarlet}}{\text{green, blue-green.}}$

Three colours and three complementaries $\frac{\text{red, orange, yellow}}{\text{blue, blue-violet, violet}}$

Four colours and four complementaries—orange, yellow, yellow-green, green
blue-violet, violet, purple, crimson.

Five colours and five complementaries—red, orange, yellow, yellow-green, green
blue, blue-violet, violet, purple, crimson.

One colour and one complementary
crimson
green.

Two colours and two complementarics
red, orange
blue, blue-violet.

Three colours and three complementaries
red, orange, yellow
blue, blue-violet, violet.

Four colours and four complementaries
scarlet, red, orange, yellow
blue-green, blue, blue-violet, violet.

Five colours and five complementaries
red, orange, yellow, yellow-green, green
blue, blue-violet, violet, purple, crimson.

Three colours—red, orange, yellow

Five colours—orange, yellow, yellow-green, green, blue-green

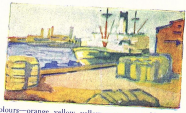
Four colours—green, blue-green, blue, blue-violet.

Six colours—yellow, yellow-green, green, blue-green, blue, blue-violet

Three colours—blue-green, blue, blue-violet

Four colours—blue-violet, violet, purple, crimson

Five colours—yellow, yellow-green, green, blue-green, blue



Six colours—orange, yellow, yellow-green, green, blue-green, blue

Two colours and one mutual complementary
yellow, yellow-green
violet-purple

Three colours and one complementary
purple, crimson, scarlet
green

Three colours and two mutual complementaries
red, orange, yellow
blue-blue-violet, violet-blue-violet

Four colours and one mutual complementary
yellow-green, green, blue-green, blue
scarlet-crimson

Four colours and two mutual complementaries
red, orange, yellow, yellow-green
blue-violet, violet

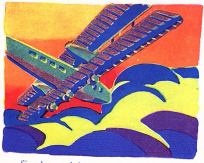
Four colours and three mutual complementaries
red, orange, yellow, yellow-green
blue-blue-violet, violet-blue-violet, purple-violet

Five colours and four mutual complementaries
blue, blue-violet, violet, purple, crimson
red-orange, yellow-orange, yellow-yellow-green, green-yellow-green

Five colours and one mutual complementary
red, orange, yellow, yellow-green, green
violet

Five colours and two mutual complementaries
green, blue-green, blue, blue-violet, violet
scarlet-red, red-orange

Five colours and three mutual complementaries
red, orange, yellow, yellow-green, green
blue-violet, violet, purple



Six colours and three mutual complementaries
scarlet, red, orange, yellow, yellow-green, green
blue-blue-violet, blue-violet-violet, purple-violet

Six colours and four mutual complementaries
scarlet, red, orange, yellow, yellow-green, green
blue, blue-violet, violet, purple

Six colours and five mutual complementaries
yellow, yellow-green, green, blue-green, blue, blue-violet
violet-purple, purple-crimson, crimson-scarlet, scarlet-red, red-orange

Green

Orange

Crimson

1—3. $\frac{\text{C-S-R}}{\text{B4}_{\text{v}}}$

2—3. $\frac{\text{C-S-R}}{\text{G-B4-B}}$

1—4. $\frac{\text{C}}{\text{G}}$

6—5. $\frac{\text{P-C-S-R-O-Y}}{\text{YG-G-BG-B-BV-BVV}}$

4—4. $\frac{\text{P-C-S-R}}{\text{YG-G-BG-B}}$

3—5. $\frac{\text{R-O-Y}}{\text{B-BV-V}}$

Harmonies in four. C-S-R-O

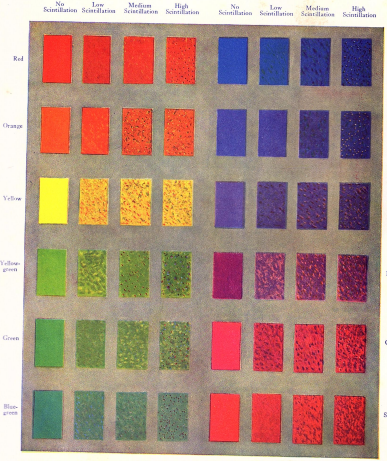
broken up into crimson, purple, blue-violet, and blue. In other words, all colours that are broken into the yellow would be in a yellow atmosphere, and all colours that are broken into the violet would be in a violet atmosphere. This has been successfully done by some artists who are now using this colour theory.

Many compound combinations can be made in this way to suit the individual taste of the artist.

CHAPTER FIVE: LIGHTS AND SHADOWS—THE SHADOW OF AN OBJECT GOES TOWARD ITS COMPLEMENTARY

LL shadows of any object, no matter what colour, will be a different colour than the lighted side. Not only will it be darker in black-and-white value, but to have the effect of light on colour it will be necessary to make the colour of the shadow a colour which is toward its complementary. The more light that is on an object, or the more brilliant the colour, the nearer the shadow will be to its complementary colour. All pigmentary colours that are orange, red, scarlet, crimson, purple, and violet go counter clockwise toward their complementaries for the shadow colour. All pigmentary colours that are yellow, yellow-green, green, blue-green, blue, and blue-violet go clockwise to their complementaries on the Spectrum Chart. Metallic surfaces go both ways to their complementaries, simultaneously. This accounts for the iridescent effect of copper, brass, and other metals. It has been found by experiment that this is the reason for the metallic surface in contradiction to a pigmentary surface. However, a thing must not necessarily be of metal to have a metallic surface. We have metallic paint, iridescent glass, etc., while pigmentary surfaces include dyes for cloth as well as paints which are used for water colour and oil.

The most difficult of all surfaces to secure as to colour and texture is flesh, which I have found to be a texture between the metallic and the pigmentary surfaces. It must be borne in mind that the blood flowing under the surface of the skin is of two colours—the arterial blood, which is very nearly a scarlet as seen through the skin, and the venous blood, which seen through the skin is a blue-green because of the yellow-orange colour of the skin. After it has become oxidized by passing through the lungs, the venous blood changes into scarlet. Therefore, flesh has a great deal of blue-green and scarlet in its local colour, and of the colours toward their complementaries on the shadow side. For example, flesh in a half tone very often shows a green or sometimes a neutralized blue or blue-violet shadow. Where it shows the red blood—in the cheeks, the lips, and so forth—very often the flesh casts a purple shadow. Therefore, on account of these two colours which are in the flesh, the effect to our eyes is very nearly that of the metallic surface. Of course the scarlet and blue-green are modified by the colour of the flesh which in itself is a light yellow-orange. In many places where the blood does not come to the surface very noticeably the shadows will go toward the complementary of the yellow-orange colour of the skin.



Showing the components of each colour

COPPER AND BRASS

Showing the shadow going both ways to the complementary

BLUE VASE

Showing the shadow going to its complementary as far as purple in sequence with orange highlight

All these colours and their shadows will of course be modified by their surroundings producing different colours because of the simultaneous contrast and the reflected lights of their surfaces.

How near the shadows are to their complementary colours depends on the amount of light on an object; the more light the nearer they are to the complementary. As all shadows are down in tone they are neutralized with their own complementaries as is shown in Colour-Mixing Charts.

It must be borne in mind that the shadow colour is dependent on the colour of the lighted side. Because an object is blue locally is no reason that it is always blue. In fact, yellow very often has an orange-yellow and yellow hue on the lighted side. In that case, the shadow would go both ways on the Spectrum Chart. If a red flannel shirt were shown in the sun on the Equator, the shadow side of the shirt would go counter clockwise toward its complementary and would be neutralized blue-violet (2-B), Colour-Mixing Chart (Plates II–III). If the same shirt were shown in the sun in the North Temperate Zone the shadow side would be neutralized violet (2-B). If shown out of the sunlight under a blue sky it would have a shadow slightly more toward purple, and if under a clouded sky, the shadow would be a more direct neutralized purple. (See Plate XXIII.)

Now bring the shirt indoors into a well-lighted room, a north light, and it will have a shadow between purple and neutralized crimson. If in a room not north lighted the shadow would perhaps only go as far as the scarlet. But the shadow always goes toward its complementary. Of course, all shadows are additionally modified by reflected light. The blue sky would increase the blue light in the shadow; or the walls of the room would be reflected.

When painting any object which has a scintillation, it is necessary to break into it with its two spectrum components and its complementary. Blue is made up of the violet and green rays. Therefore, blue should be broken into with these two colours, and if it is desired to have more movement of colour, break into this blue a little of its complementary, red. This can be done in a number of different ways, one of which is by getting all the colours on the brush at one time and putting directly on the canvas, or at least not mixing well on the palette. The hairs of the brush will separate the colours in oil painting. A palette knife will also keep the colours separated. Or the colours can be put on with a small brush, each separately. At all times it is well not to mix thoroughly on the palette, thereby giving more life to the colour. Further examples would be yellow, broken into its components, red and green, and its comple-

mentary, violet. Green would be broken into its components, blue and yellow, and its complementary, crimson.

It has been said that white is the "highest light" and black the "darkest dark." But is this really true? You will find the "darkest dark" is the complementary neutralized and the "lightest light" *the direct complementary with white.* This is a new theory, I know, and perhaps upsets some deep-rooted ideas, but you will find this always true: that the high light of a shining surface is always a direct complementary to its lighted side; example: a blue-violet glazed vase (Plate XVIII) will have a high light that is orange with a great deal of white. The high light on a nose always will be the complementary colour with white of the lighted side of the nose and not just white as so many portrait painters paint it.

For the benefit of those artists who wish to use the broken colour method to get scintillation and vibration the following table has been compiled for ready reference. (See chart, Plate XVII.)

SPECTRUM PRIMARIES:

Red

Low scintillation: break into with orange and scarlet.
Medium scintillation: break into with its components, yellow and crimson.
High scintillation: break into with its components, yellow and crimson and its complementary, blue.

Green

Low scintillation: break into with yellow-green and blue-green.
Medium scintillation: break into with its components, yellow and blue.
High scintillation: break into with yellow and blue in addition to its complementary, crimson.

Violet

Low scintillation: break into with blue-violet and purple.
Medium scintillation: break into with its components, blue and crimson.
High scintillation: break into with its components, blue and crimson, in addition to its complementary, yellow.

PIGMENTARY PRIMARIES (or Secondaries of the Spectrum):

Yellow

Low scintillation: break into with yellow-green and orange.
Medium scintillation: break into with its components, green and red.
High scintillation: break into with its components, green and red, in addition to its complementary, violet.

Blue

Low scintillation: break into with blue-green and blue-violet.

Medium scintillation: break into with its components, green and violet.

High scintillation: break into with its components, green and violet, in addition to its complementary, red.

Crimson

Low scintillation—break into with purple and scarlet.

Medium scintillation—break into with its components, violet and red.

High scintillation—break into with its components, violet and red, in addition to its complementary, green.

HUES:

Orange

Low scintillation: break into with yellow and red.

Medium scintillation: break into with its spectrum components, red and green, more red than green; or its pigmentary components, yellow and crimson, more yellow than crimson.

High scintillation: break into with its components, either spectrum or pigmentary, and its complementary, blue-violet.

Yellow-green

Low scintillation: break into with yellow and green.

Medium scintillation: break into with its spectrum components, red and green, more green than red; or its pigmentary components, yellow and blue, more yellow than blue.

High scintillation: break into with its components, either spectrum or pigmentary, in addition to its complementary, purple.

Blue-green

Low scintillation: break into with green and blue.

Medium scintillation: break into with its spectrum components, green and violet, more green than violet; or its pigmentary components, yellow and blue, more blue than yellow.

High scintillation: break into with its components, either spectrum or pigmentary, in addition to its complementary, scarlet.

Blue-violet

Low scintillation: break into with blue and violet.

Medium scintillation: break into with its spectrum components, green and violet, more violet than green; or its pigmentary components, blue and crimson, more blue than crimson.

High scintillation: break into with its components, either spectrum or pigmentary, in addition to its complementary, orange.

Purple

Low scintillation: break into with violet and crimson.

Medium scintillation: break into with its spectrum components, violet and red, more violet than red; or its pigmentary components, crimson and blue, more crimson than blue.

High scintillation: break into with its components, either spectrum or pigmentary, in addition to its complementary, yellow-green.

Scarlet

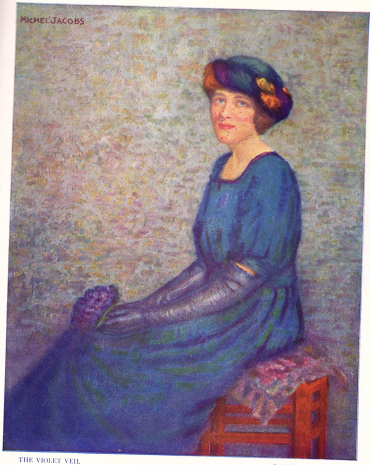
Low scintillation: break into with crimson and red.

Medium scintillation: break into with its spectrum components, violet and red, more red than violet; or its pigmentary components, crimson and yellow, more crimson than yellow.

High scintillation: break into with its components, either spectrum or pigmentary, in addition to its complementary, blue-green.

Hues between these colours are obtained in the same manner.

If it is desired to have brilliant colours, full saturation should be used. If neutralized or mixed with white, the components and complementaries should be in the same shade or tint so as to keep the colour in the same plane.



THE VIOLET VEIL

By MICHEL JACOBS

A portrait done in split complementaries of five colors and one mutual complementary. (blue-green, blue, blue-violet, violet-purple and orange.)

The shadow in each case going towards its complementary.

CHAPTER SIX: COLOUR FOR THE PORTRAIT PAINTER

IN PORTRAIT painting, the first thing that interests the artist is to paint the character and likeness of the sitter. This part of the task he realizes interests only those who know the person whose portrait it is. But there is a higher object to be attained and that is to make a decoration and to interpret a personality—something that has value from the æsthetic point of view. This is arrived at by two means; first, by composition of form and line; and second, by colour. It is with the latter that we have to deal in this chapter.

In arranging the setting for the portrait, the most important thing is to decide what colour combination is adaptable to the sitter. For a child, one should select colours that show something of the child's temperament. If the child has a spiritual face, a combination of harmonies in grays, such as, blue-gray, blue-green-gray, green-gray, yellow-green-gray, all with white, 1-D or 2-C or 3-B in Colour-Mixing Charts (Plates II–III), would show very well with a child who has not much colour in the face, for these will bring out what little colour exists. For a child full of life with red cheeks and lips the colour should be more brilliant or neutralized only a little. A combination of complementaries could be used as follows: scarlet, crimson, purple, with one complementary and green. This is known as three against one, crimson 1-A, scarlet 1-B, purple 1-B, green 1-A.

For a man's portrait strong or dark colours should be selected and generally in harmonies of three or four colours such as red, orange, and yellow, grayed with their complementaries, 2-A or 2-B in Colour-Mixing Charts (Plates II–III).

In painting the portrait of a young girl one should use youthful tones, such as the complementaries of three and three or four and four, although sometimes a harmony of light and brilliant colour is in good taste.

The portrait of an older woman should be painted in neutralized colours depending on the character of the sitter (see chapter on Psychology of Colour).

As the background of a portrait is behind the sitter, it is advisable to make the head the most brilliant spot of colour in the picture. This does not mean that the head should be lighter in colour but that the most brilliant colour should be painted into the head.

The head, clothes, and drapery in a portrait are greatly influenced by the colour of the background. If the background is a brilliant yellow, black cloth would look neutralized violet because of the simultaneous contrast to the eye. Therefore, if it is desired to make the picture look like black and yellow, it is necessary to paint this black with neutralized green or neutralized red (3-A in Colour-Mixing Chart, Plates II–III). This will give the black effect in tone,

whereas if painted with neutralized violet it would be a contrast. All other colours are influenced in the same way, especially neutral gray or white.

The head has many colours and to tell exactly which should go into flesh is like describing the rainbow. Quoting from the previous chapter, "Lights and Shadows," "The most difficult of all surfaces to secure as to colour and texture is flesh, which I have found to be a texture between the metallic and the pigmentary surfaces. It must be borne in mind that the blood flowing under the surface of the skin is of two colours—the arterial blood, which is very nearly a scarlet as seen through the skin, and the venous blood, which seen through the skin is a blue-green because of the yellow-orange colour of the skin. After it has become oxidized by passing through the lungs, the venous blood changes into scarlet. Therefore, flesh has a great deal of blue-green and scarlet in its local colour and of the colours toward their complementaries on the shadow side. For example, flesh in a half-tone very often shows a green or sometimes a neutralized blue or blue-violet shadow. Where it shows the red blood in the cheeks, the lips, and so forth, very often the flesh casts a purple shadow. Therefore, on account of these two colours which are in the flesh, the effect to our eyes is very nearly that of the metallic surface. Of course the scarlet and blue-green are modified by the colour of the flesh which in itself is a light yellow-orange. In many places where the blood does not come to the surface very noticeably the shadows will go toward the complementary of the yellow-orange colour of the skin." A red-haired girl in a white light with violet haze in the skin, surrounded by draperies of violet, blue-violet, blue, blue-green, and green, all neutralized (1-2 and 1-B and 2-C in Colour-Mixing Chart, Plates II–III), the background violet predominating, is painted:

Hair: Half tone: neutralized red and neutralized orange 1-B.
Shadow: crimson and purple 2-A or 3-A.
Reflected light in shadow: violet 1-C.
High lights: orange, yellow, and a small quantity of violet O-A and O-D.

Flesh: Half tone: scarlet, red, orange O-C and 1-C.
Shadow for cheeks: scarlet, crimson, purple, 1, 2, 3-A or B.
Shadow for chin: yellow-green 1, 2, 3-A or B.
High light on cheek: purple O-D.
High light on nose: crimson O-D.
High light on forehead: yellow O-D.
High light on temple: blue-green O-D.
Reflected light from background: purple 1-C.

By using the colour correctly it is not necessary to paint black or brown shadows to get solidity, as the contrast in colour will give the solidity of form. Of course, the flesh must seem to vibrate if it is to show the quality or texture of flesh. This can be done by following the same idea as given in Chapter V, "Lights and Shadows"; i.e., breaking a colour into its two components. This one example will give some idea of how colour should be used in portraiture.

The old method of using colour of the background to mix with all shadows only gives us a picture in monochrome. If one wishes to paint the colours of nature with all the wonderful effects that it has on our eyes he must study colour. Using a photograph, as some portrait painters do, "as a guide only," will give only a photograph with colour tints. The portraitist must be, first of all, a good draftsman so that he is not afraid to lose his drawing while painting, and he must be able to see colour and know how to apply what he sees. How many so-called portrait painters do? In this branch of the arts the portraitist seems to be far behind the landscapist. Some portrait painters tell us that colour does not change indoors as it does outdoors, but they are mistaken. The laws of light and colour never change. It is only more difficult to see the colour of different atmospheres indoors, for that is really the problem. Colours are not always shades of green or blue. We have not always a white or blue reflected light from the sky. Black or white never exists indoors more than out of doors, and shadows invariably go toward their complementaries in the same way, only in the open it is easier to see because they go farther toward their complementary colours. (See chapter on "Lights and Shadows.")

To attempt to give the colour of any object in an arbitrary way is impossible. If the painter studies still life as directed in Chapter V, he will have no trouble in giving to his portraits the "light of life" and he will no longer paint leather flesh and wooden hair.

CHAPTER SEVEN: COLOUR FOR THE LANDSCAPE PAINTER

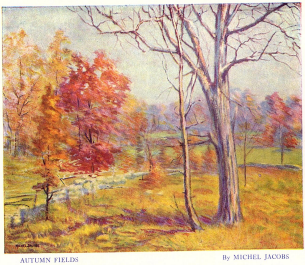
N THE old school of painting, when starting a landscape, one was taught to paint in the so-called warm colours first and the cold colours last. By this new method, one should paint with cold colours first as described in Chapter VIII. This will give cool underpainting. If we look at some of Michelangelo's unfinished work we find that he started to paint his pictures with blue, green, and white in contradiction to the Venetian School which used browns and reds in the underpainting. Of course, the old masters allowed their first lay-in to dry, but in our modern way of direct painting we can lay our warm colours directly on the wet cool colours.

If we divide the Spectrum Chart in half and use all the colours which are in one half (a harmony), we will not employ a muddy colour in starting our picture, and as our paint dries a little we can add our warm colours without danger of losing their brilliancy. It is preferable to draw the picture with a brush with one colour, as charcoal or lead is very apt to work through in time. Blue-green or ultramarine blue are good colours to start with.

All colour in nature is dependent on its surroundings. For example, if we look through yellow-green foliage at a seemingly blue sky, the colour of the sky will appear to be purple with white. The same sky will look green when seen through scarlet autumn foliage. This is known as "simultaneous contrast." If the sky looks blue it will be composed of the green and violet rays of light. It is necessary, therefore, to break up the blue of the sky with green and violet and perhaps the complementary of blue, which is red. This red will have a great deal of white in its mixture and produce a colour which would be O-A in the Colour-Mixing Chart (Plate II). If the sky is not very blue it will be necessary to paint only with violet and green and white, not using blue at all.

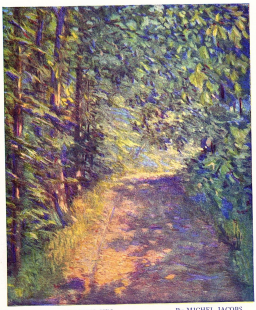
You will observe that the dome of the sky is a series of hues of colour. For instance, if the sun is on the horizon, the zenith will be a blue-violet and the horizon a yellow-green and all the shades between these two colours running counter clockwise on the Spectrum Chart, Fig. 1. At high noon, the sun being directly overhead, this order will be reversed. It is necessary to study the colour of the sky very closely before starting to work. The study of clouds is given in Chapter IX. After painting the sky, one might paint in the middle distance, at the same time painting small particles of colour in the middle distance and foreground to give the range of colour.

Distant hills and trees and grass partake of the colour of the atmosphere, which is blue-violet. Therefore, all distant objects will have a certain amount



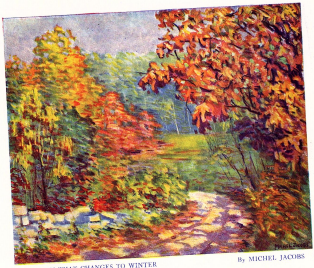
AUTUMN FIELDS — By MICHEL JACOBS

Showing shadows going toward their complementary



IDYL OF A SUMMER'S SUN — By MICHEL JACOBS

Sunlight and shade



AUTUMN THAT CHANGES TO WINTER — By MICHEL JACOBS

The effect of coloured light on colour.
Red filter will change this picture to a winter landscape.
Yellow filter will show a tonal effect.

Red under a very strong light

Red under a strong light

Red under a medium light

Red under a subdued light

SHOWING THE EFFECT OF DIFFERENT INTENSITIES OF LIGHT ON RED BY THE SHADOW GOING FURTHER TOWARD ITS COMPLEMENTARY

Plate XXIII

of the blue-violet broken into their individual colour. Also, as objects recede from the eye, the darks become lighter and the lights become darker until at a great distance they seem to melt into one flat tone. Do not forget, however, that the shadows of an object go toward its complementary and that where the shadow is at all discernible the colour will be toward the complementary of the lighted side of the object. For example, the lighted side of a yellow-green tree in the far distance will be a yellow-green mixed with white, let us say 1-B. The shadow would be blue 2-B. Both of these colours would be broken into with a blue-violet 1-B. Of course the distance should be kept as simple as possible.

The middle distance will have more colour than the distance and will show more clearly the difference between light and shade, but here also the blue-violet of the atmosphere must be broken into all colours especially strong in the shadows. (See Plate IV.)

In the foreground, the colours will be a little more local and there will be less of the colour of the atmosphere broken in with them. The shadows and lights should be of greater contrast. One should always compare the colour values of the distance, middle distance, and foreground one with the other.

One can paint any colour in the distance and still make it appear to recede if less contrast is made of colour and value. In the old school, blue was thought to be a receding colour and yellow an advancing colour, but if one were to paint the yellow at a distance mixed with white and paint the shadows a green-yellow with white, and the blue in the foreground with neutralized purple shadows, the yellow in the distance would appear to recede and the blue in the foreground would appear to advance. The farther toward the complementary colour one paints the shadow colours the more light will appear to be on the object; and the more neutralized and darker the shadows are, the nearer the object will appear.

As we paint our pictures outdoors in "plein air," the light of the sky makes our paints look nearer to nature's handiwork; but when they are displayed indoors, where there is much less light, our paints lose in brilliancy to such an extent that we must counterbalance this loss by painting more brilliant colour so that our canvases resemble the sunlight that we saw in the open.

CHAPTER EIGHT: SUNLIGHT OUTDOORS AND IN

NATURE has beautified the earth with colours that are brilliant beyond the power of man to imitate. We can only strive to follow what nature is so prodigal of. As we have less light indoors than in the open, it is necessary to go a little further toward the complementary to give the same effect of light. If we do this it will be unnecessary to paint dark shadows or get a false black-and-white value, for nature never paints in black or white. This is a conventional form of painting. It is a man's law but has no truth in nature. Colour values are the only things we see if our eyes are normal.

In the spring or summer we can start our picture in a harmony of blue-green, blue and blue-violet, violet and purple. When we have secured the light and dark spotting desired, paint the lights yellow-green, yellow, orange, and red.

For example, first paint the light side of a tree with blue-green mixed with white and the shadow with blue, violet, and purple; breaking into this with yellow-green, yellow, and orange to represent the sunlight, and green perhaps to show the light of the sky. Paint the trunks of trees in blue, violet, and purple, at first, and the sun-lighted spots afterward with orange, red, scarlet, or crimson with more or less white. Of course, it is understood that your colours can be neutralized or made brilliant depending on the effect desired.

You may want a mural painting in pastel tints, or you may want a startling effect to look brighter perhaps than nature itself.

This is only one suggestion as to how to start a picture; in many instances it will not be possible to follow this scheme, because all colours change by juxtaposition and simultaneous contrasts. A very startling example of this is seen when looking through green foliage at a blue sky (see preceding chapter). The sky looks purple with white through the small round holes. Distant colours should be neutralized with white in both the lights and shadows.

Very often this will be found to supply sufficient neutralization, especially if it is desirable to have the picture in a high key. The colour of the atmosphere should be mixed with the colour for distant objects, especially in the shadows but not so much in the lights.

Foreground colours are more neutralized with their complementaries to represent more local colour and less atmosphere.

In the autumn the picture may be started with blue, blue-violet, violet, purple, and crimson, with the yellow, orange, and red lights laid in afterward, or the reverse method may be adapted. The idea is to keep the brilliance of every colour and to avoid accidental mixing of the complementaries on the canvas.

In the winter, start with blue, blue-violet, violet, and purple, laying the snow in the shadows with blue-green, blue, blue-violet mixed with white and the lights with yellow, orange, and red with white. Of course, one should always remember the broken colour as explained in Chapter V, on "Lights and Shadows."

When sunlight enters a room it not only shows the yellow or orange beam of light but it also gives a colour tone which affects the light of the entire room. This, taken into consideration with the lack of blue sky directly reflected and no great distant atmosphere colour with which to contend, makes the sunlight indoors a separate problem, but if we remember that the law of the effect of light on colour never changes, we can very readily understand it. The light that enters a room is a reflection of the sky and is reflected again on all objects by the walls, ceiling, and other objects. A beam of yellow sunlight entering will modify all these colours and reflections. All objects that are lighted by the reflected light seem dark in comparison, and by simultaneous contrast seem to partake of blue-green, blue, blue-violet or violet tones; but the shadows seem neutralized purple or crimson. In other words, the whole mass that is lighted by the reflected light assumes a colder set of colours in harmony and they receive a reflection from the warmer beam of light. It is as if all objects were lighted by two distinct coloured lights, the stronger light being reflected into the objects that are lighted by the lesser light. This would give the effect on the eye of simultaneous contrast.

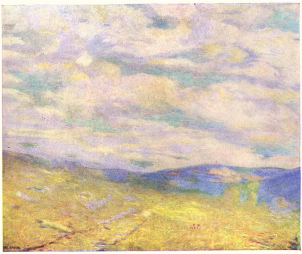
CHAPTER NINE: CLOUDS

OF ALL the wonders of nature, perhaps the most wonderful is the heavens with the different kinds of clouds and their ever-changing colours. One could spend a lifetime studying this phase of art alone. But like all other things in nature it is the application of the law of light on colour which makes us conscious of their beauty.

"The more intense the light on an object the farther toward the complementary colour will the shadow colour go." As the light on a cloud is the strongest light and since it is our object to make this strongest light very luminous, it is well to make the shadow a direct complementary to its lighted side (toward the source of light), and gradually diminish the distance toward the complementary as we go away from the source of light. For example, if the lighted side of a cloud is yellow with white, the shadows would be violet near the sun; and receding from the sun the shadows would tend toward blue-violet. These colours would be neutralized or brilliant, depending upon whether the brightest part of the sky were in the zenith or near the horizon. If the sun is near the zenith the clouds are lighted on the upper sides and O-D in Colour-Mixing Charts (Plate XXIV) should be used. This colour will be slightly neutralized with its complementary, violet, in the direction of the horizon. This is because of the greater distance of the clouds from the observer with the larger amount of atmosphere in a lateral direction in comparison with the atmosphere above. The shadows will be a slightly neutralized violet with white near the source of light, 1-D in Colour-Mixing Charts, and a more brilliant blue-violet as the cloud approaches the horizon, O-D in Colour-Mixing Charts. The reason for the neutralization of the shadows is to increase the effect of brilliancy toward the zenith. By making the blue-violet brilliant toward the horizon, at the same time neutralizing the lighted side and changing the shadow colour from violet to blue-violet the effect of increasing distance toward the horizon is obtained and at the same time the effect of increased luminosity is achieved.

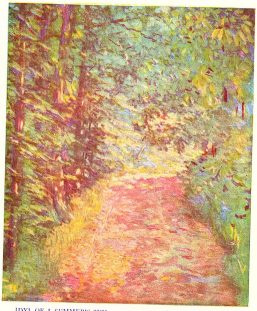
In a sunrise or sunset the lighted side of the clouds changes from yellow-orange to purple in sequence, counter clockwise, on the Spectrum Chart, and the shadows will go *DIRECT* to the complementary near the source of light and only *TOWARD* the complementary as the cloud forms go farther from the sun.

It can be readily understood that when the setting sun divides the rays of light, parts of the heavens show a sequence of colour from yellow-orange to purple on the lighted side, and the shadows change



ROVING CLOUDS — By MICHEL JACOBS

Showing the shadow of clouds going directly to the complementary of the lighted side



IDYL OF A SUMMER'S SUN — By MICHEL JACOBS

Sunlight and shade in green tones

from neutralized violet near the source of light to neutralized green near the zenith.

Moonlight is nearly a blue-green light and as it is not as brilliant as the sun it is never necessary to go direct to the complementary shadow colour, and the shadow of course is always neutralized.

CHAPTER TEN: REFLECTED COLOUR IN WATER

WE MUST remember that water is, more or less, only a perfect mirror and will reflect objects on its surface at the same angle as the line of vision. In scientific terms, "the angle of incidence is equal to the angle of reflection." For example, if you look straight down into a smooth body of water you will see the sky, directly overhead, reflected in the water, or perhaps your own face, but if you look at the surface at an angle of say 30° you will see any object which is reflected at the same angle. In a simpler way, a line drawn from your eye to the surface of the water and up again at the same angle from the surface of the water as the line from your eye, it would show you the angle of reflection.

The above applies to water that is quiescent. When the water has waves or ripples, the angle is changed from a level plane and a number of different small reflections result depending on the angle formed by the wave or ripple to the eye of the observer, so that while the main body of the water reflects what is in front of you, the waves or ripples may reflect what is behind you.

The first thing to be determined in reproducing this effect on canvas is what is being reflected from the surface of the water to the eye, for, of course, you understand the reflection is not a tangible thing like a shadow, and will change as we view the water from different angles. When the objects and colours reflected have been determined they should be painted as they appear in the water, in neutralized tones of the objects themselves. For example, if a tree is O-A in Colour-Mixing Chart, the reflection would be about 1-A or 2-A.

It is best to paint the strokes of the brush in more or less the same direction as the movement of the water and try to form interesting patterns in the handling. At the same time, remember that the small ripplet may reflect the sky in among the reflections of the foliage of the tree. The edges of the reflection will be broken in jagged forms to correspond to the surface of the water.

The distant colours will melt into one another as described in Chapter VI, but as the water recedes the angle of vision is changed and becomes straighter.

As the reflections are only on the retina of the eye (or flatplate of a camera), and are not really existent on the water, the reflections will all meet at a focus in the eye. If you reverse the principle of perspective and have the point of sight in the eye, to which all lines at right angles with the horizon converge, you will get a rough idea of this principle. If trees are upright and reflected in the water, the reflections will meet at the eye, but if the trees are not upright, the reflection will not be at a right angle but will slant in the opposite direction to the angle of the tree.

CHAPTER ELEVEN: PSYCHOLOGY OF COLOUR

E ARE told by many that every colour has its particular meaning and awakens a certain emotion in our minds. But is this a fact? Will all these emotions be felt by people alike or is it one of those beautiful myths like the language of the flowers or the tale of the brook—man's poetic soul picturing for himself some ideal fancy? Is it not a legacy from our Grecian or Roman forefathers, something taken from the land of dreams? Perhaps, like all myths, it has a breath of truth woven into its gossamer folds, as the glistening jewel of dew in the spider's web.

I will attempt to give an idea of the meaning of colour and its effect on the human mind, based perhaps on a new theory, but one which to me has more logic than the old, though beautiful, traditions; for I am striving in this book to give truths based on the laws of nature rather than on the conceptions of man.

A note of music, a particular perfume, a flower awakens in our minds a certain train of thought—recollections of long-forgotten days of childhood, memories of those that are no more or perhaps of things that are fearful to us. Memory, through the association of ideas, makes us like or dislike many things. So certain colours or combinations of colours are very often liked or disliked as a result of previous experiences, sometimes quite unconsciously, sometimes long forgotten.

From many experiments made with pupils I have succeeded in finding—where they liked or disliked a certain colour—that the psychological reaction could be traced to an early experience. Space prevents me from giving more than a few of the many hundred instances.

A young girl hated yellow-green. In her childhood—when she was about six years old—while playing on the lawn someone threw a bad egg in her direction. After that, whenever she saw this yellow-green colour she unconsciously had a feeling of unpleasantness. Until called to her attention she had never associated this dislike of yellow-green with this incident before. Another young woman disliked neutralized scarlet. We spent many hours trying to find out the source of this dislike. It seems that one day while still a child she found her pet dog, dead. It had been run over by a vehicle, and had been dead for many hours. The blood had dried, and the sight of it caused her to shudder. When she recalled the incident she was very sure that this was the reason for her dislike of neutralized scarlet. Another young woman disliked the same colour: she had been in San Francisco at the time of the great fire and had seen wagonloads of dead being carted over the city, the dark

red blood running from the wagons. She almost fainted when she recalled the incident.

A young man had a dislike for navy blue (blue neutralized): when a boy he came from Canada in a blue blanket coat and was compelled to wear it to school in New York where he was unmercifully teased about it by his schoolmates. A man who hated emerald green recalled that when a lad someone had given him a sip of Crème de Menthe. It had made him ill.

I am sure that if you will delve into the days of your early youth, into the most impressionable days of your life, you, too, will recall some association of ideas which will account for your like or dislike of a particular colour.

Perhaps this theory has destroyed for a moment some poetic fancy. One dislikes those who tear down where they do not build again, but I have given these examples to show that likes and dislikes of colour are based primarily on early experiences and the association of ideas, with recollections of the past which make us link the past with the present and even the future.

Many of us who have been reared in the Occident, whose history and traditions come from a common source, have been taught that certain colours mean certain things, and by constant association have felt this emotion when seeing certain colours.

To the Chinese, blue is a sign of mourning and yellow the symbol of nobility.

To us, red is the symbol of war, passion, danger, courage; orange symbolizes glory, heat, laughter, harvest, plenty, autumn, happiness, warmth; yellow stands for cowardice, indecency, decay, deceit, inconstancy, sickness; yellow-green for youth, cheerfulness, peace, faith; green symbolizes victory, and to the Irishman, patriotism; blue-green is half mystery, song, poetry, aloofness; blue suggests coldness, spirituality, serenity, mystery, truth; blue-violet conjures thoughts of the ocean and of distance; violet symbolizes sadness, sentimentality, piety; purple is the badge of royalty, richness; crimson is the colour of beauty, glorious generosity; scarlet is the sign of blood and anger; white is the symbol of purity, sacrifice, and winter, and black that of death, despair, night.

This symbolism is based on our early association of these colours with the qualities which they are supposed to convey, but so far I have been unable to find any basis of scientific fact which would justify any theory of physical or mental reaction to the wave lengths of light which we know as these colours. A red flag was used by the Romans as a gauge of battle. As a battle entails physical danger, the colour came to suggest danger. Mars, the god of War,

WINTER REFLECTIONS — By MICHEL JACOBS

Showing the effect of colour in the distance influenced by snow, and reflections meeting at a point in the eye of the observer.

SPRING — By MICHEL JACOBS

Showing the effect of the afternoon sun

was always represented in a red chariot and was the bravest of the brave, and so red likewise became the symbol of this quality.

Another example is purple. We have read of the purple robes of royalty since history began. The purple dyes of Tyre were the most expensive of all colours; only a king could buy them!

If you would read a picturesque history of colour psychology I must refer you to other sources since here I give you accepted facts and a few reasons wholly disassociated from intriguing but in most cases fantastic theories and far-fetched hypotheses.

CHAPTER TWELVE: COLOUR FOR COLOUR PRINTERS

PRINTING has been said to be the "art preservative" of all arts, and if it is to preserve for future generations the work of our artists in manifold copies then it must reproduce that work faithfully in colour. So little is understood about colour by the printer and plate-maker that many mistakes are made by experimenting and hand-cutting of plates without knowledge, which is extremely costly and wasteful, whereas a little advice and study would lead to much better work at less cost. Most of our colour printing to-day is done by Photo-colour work—Ben Day, Flat-zinc plates, Lithographic stone, Offset, Rotogravure, Woodcuts, Linoleum cuts, Mezzotints, Aquatints, and coloured Etching. Let us take up each one of these printing arts separately.

Those who are conversant with modern reproduction will find much in this chapter they already know, and they will find also a new way to get brilliancy and faithful reproduction of the original.

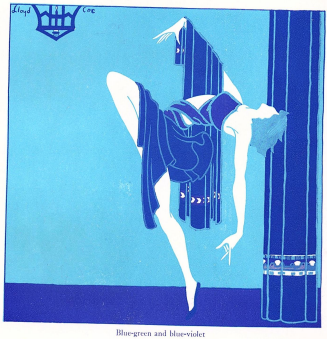
At present photo-colour printing is done with half-tone plates. These plates are reproduced from negatives made from the original art work by the use of coloured filters placed in front of the lens of the camera, and using a plate that is sensitized so that the complementary colour is photographed on the plate, and colours that are of the same hue as the filter will not register on the plate. As mentioned in the chapter on stage-lighting, and as is demonstrated in Plate XXII, all colours that are in harmony, or the same colour as the filter, show white through the filter. There are three filters now supplied the photo-plate makers in three-colour printing process, colours which I would call blue-violet, yellow-green, and scarlet (now commonly known as violet, green, and red), and for the so-called four-colour printing, a key-plate which is printed in black using a yellow-yellow-green filter. These colours are not always the complementary of the coloured inks that are used, and therefore the reproduction is seldom an exact copy of the original; especially in America there seems to be a lack of coördination between the colour-printer, the plate-maker, and the photographic material concerns. Also there is too much use made of the black plate, as with the correct three-colour printing, shadows and black can be produced richer and better without the black plate. If these three elements which are necessary for a perfect reproduction were coördinated, much beneficial work would be accomplished. In printing in the three-colour process the correct colour filters to be used would be (taking the Spectrum Chart, Plate I, as a guide) a violet, not a blue-violet; a green, not a yellow-green; and a red, not a scarlet. These colours can be found in the Spectrum Chart. The inks to be used with these

Crimson and blue-violet

Blue-green and crimson

Crimson and yellow

PRINTED IN TWO COLOURS



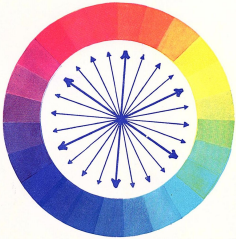
Blue-green and blue-violet

PRINTED IN TWO COLOURS

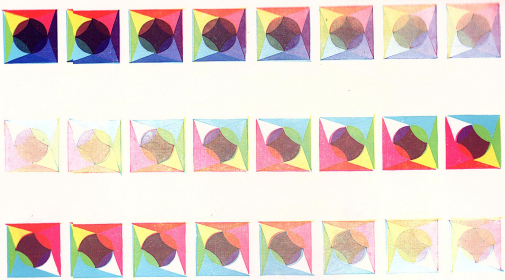
Blue-violet and yellow

PRINTED IN TWO COLOURS

PLATE XXIX



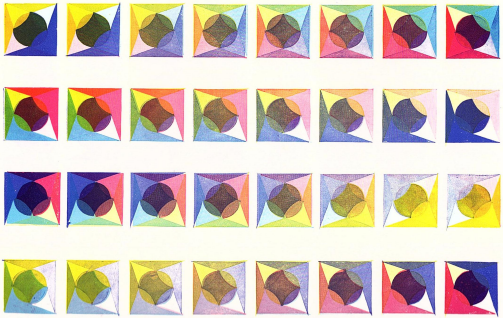
TWENTY-FOUR COLOUR SPECTRUM

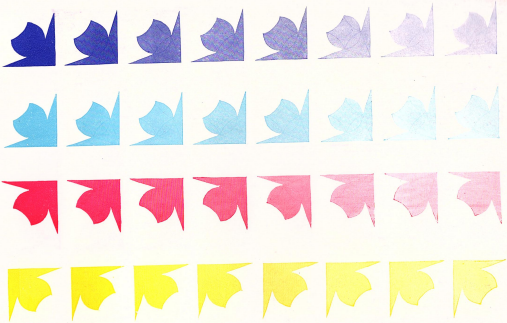


MICHEL JACOBS'S COLOUR TYPES.
Showing size of dot and combinations of different inks.
The arrow-heads showing the colour of the ink used.
The outside long triangle showing two-colour printing.
The small ovals, three-colour printing.
The centres, four-colour printing.

PLATE XXXI

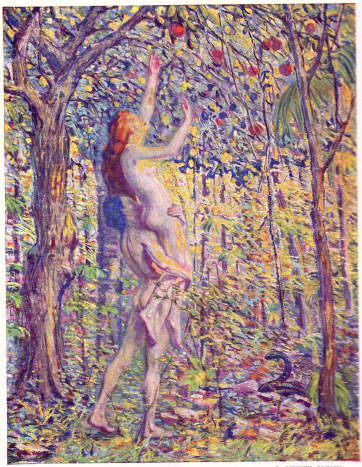
MICHEL JACOBS'S COLOUR TYPES
Showing size of dot and combinations of different inks.





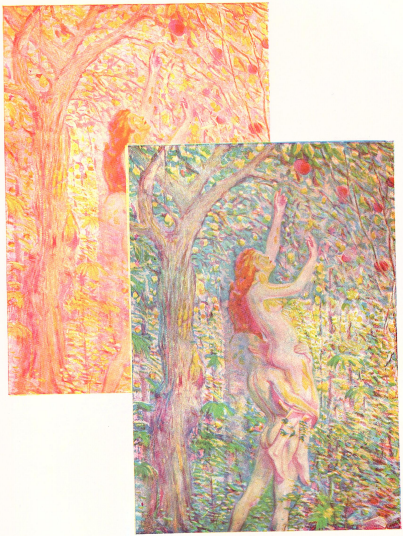
MICHEL JACOBI'S COLOUR TYPES
Showing size and combinations of different inks.

PLATE XXXIII



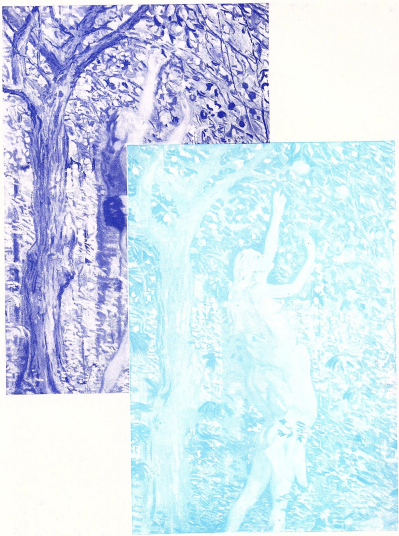
ADAM AND EVE — By MICHEL JACOBS

Printed in four colours—yellow-yellow-orange, crimson-scarlet, blue-blue-green, blue-violet-violet



PROGRESSIVE PROOF OF FOUR-COLOUR PRINTING
YELLOW-YELLOW-ORANGE, CRIMSON-SCARLET, BLUE-BLUE-GREEN

PLATE XXXV

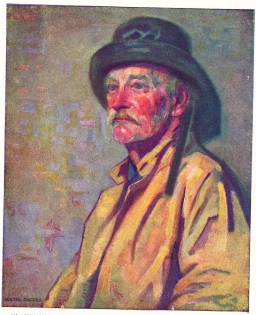


PROGRESSIVE PROOF OF FOUR-COLOUR PRINTING

PLATE XXXVI

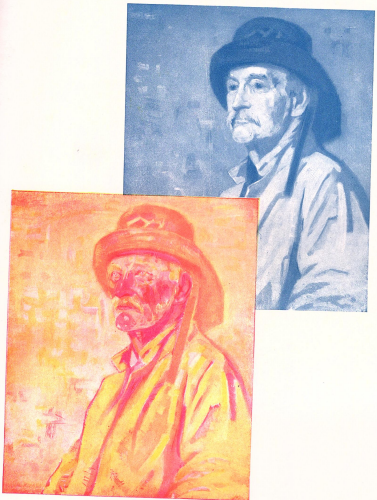
PROGRESSIVE PROOF OF FOUR-COLOUR PRINTING

PLATE XXXVII

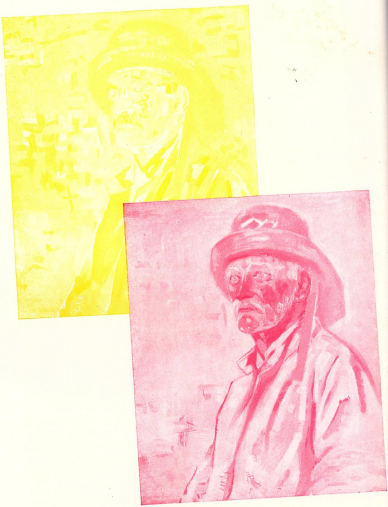


GLOUCESTER FISHERMAN — By MICHEL JACOBS

Printed in three colours—crimson, blue, and yellow



– PROGRESSIVE PROOF OF THREE-COLOUR PRINTING



PROGRESSIVE PROOF OF THREE-COLOUR PRINTING

three-colour screens or filters would be their complementaries, yellow, crimson, and blue.

It is very important that the filter to be a true complementary of the coloured inks to be used be intense enough to block out perfectly the other two colours; because if it is not intense enough the colour will be only slightly neutralized and will register on the photo plate. It will then be necessary to do a great deal of tooling to cut out the other colours. This practice of tooling has grown to such an extent that some plate-makers, especially in America, are compelled to do a great deal of unnecessary work, and often ruin the artist's original work. If the photographer will see that colour filters are the exact complementaries of the coloured inks to be used, as in Spectrum Chart, Fig. 1, there will be a great deal less hand-work on plates.

Another very important item in the making of coloured plates is the colour of the light. No artificial light at present has been discovered which is a true white light. The arc light has a slightly violet tint, but this can be rectified by using filters which correct the excess violet rays. The above-named filters, violet, green, and red, will answer this purpose.

No experiment is necessary if the printers use the crimson, yellow, and blue inks as in the Spectrum Chart, and use the filters mentioned (Plate XXXVIII).

The test for a true colour in the ink is as follows: A yellow that will make a brilliant green when mixed with blue, and at the same time when mixed with crimson will make a brilliant red, is a true yellow. A crimson that will mix with yellow and make a perfect red, and at the same time when mixed with blue will make a perfect violet, is a true crimson. A blue that will mix with crimson and make a perfect violet, and at the same time when mixed with yellow will make a perfect green, is a true blue.

So much for the present-day method of printing.

Instead of taking the above three colours—crimson, yellow, and blue inks, commonly known as red, yellow, and blue, one can divide the spectrum in four instead of in three, and take a colour ink which is a yellow-yellow-orange, a blue-blue-green, a blue-violet-violet, and crimson-scarlet (see Plate XXXI). By the combination of the yellow-yellow-green and the blue-blue-green, one can get all the shades of green and yellow-green, etc. By the combination of blue-blue-green and blue-blue-violet, one can get all the shades of blue, blue-violet, and blue-green, and by the use of blue-blue-violet with crimson-scarlet one can get all the shades of purples and violets much more brilliant than has ever been gotten with four colours. The filters for these colours should be their direct complementaries (see Plate I). It has been found necessary to

make filters of different chemicals to cut out the colours not desired to register on plate. The writer believes that this method of dividing the spectrum in four colours instead of in three has many advantages over the so-called four-colour process using the black as the key-plate, as the blue-blue-violet plate can be used for the printing of type, and will very closely approximate black. In the colour chart specially adapted for plate-makers, the combinations of colours and dots can be quickly seen. (Plate XXXIV.)

The new printing process in the preceding paragraph can also be used for the Ben Day process, and the Offset process is practically the same in regard to colour as the foregoing, except that the dot is softened on account of being printed from rubber blankets.

The Rotogravure process in colour and the Gelatine process are also in the same category in regard to colour, and the writer believes that this new four-colour process can be used to advantage in all these different processes.

If it is desired to print a picture by any of the foregoing methods in only two colours, many tones of colour can be printed as shown in the Colour-Mixing Chart, Fig. 3. For example, orange and its complementary blue-violet will give all the tones as in the Colour-Mixing Chart, including a dark neutral; red and its complementary blue in the same manner; and following in the same way each colour with its complementary, namely, scarlet and blue-green; crimson and green; purple and yellow-green; and violet and yellow. Some of the neutrals formed by these complementaries will be slightly lighter. This is much more colourful than printing with one colour and black, and no more expensive. (Plate XXVII.)

Lithography allows much more scope than any of the foregoing processes and much expense can be saved if the system of four colours is followed. The best way to explain its adaptation to this style of reproduction is to refer the reader to Chapters I, III, IV, VI, VII, VIII, and IX, as the lithographic art is more or less the same as painting, the only difference being that the colours are put on by the use of different stones instead of brushes. It also follows along lines similar to photo-colour printing, flat plate, and Ben Day. In fact, all these methods are but the outgrowth of lithography.

Woodcut printing is the same as Ben Day or flat-plate printing, only the wood is cut out by hand tools. Linoleum cuts are exactly the same as woodcuts but are cut into heavy linoleum.

Mezzotint colour printing is made by a plate which has been previously roughened by a tool called a rocker which raises many points on a copper plate. These are afterward cut off, more or less, depending on how much light or

shade is necessary. The more the roughness is scraped off the lighter will the printing be. The plate is afterward printed in colour, each colour being applied to the plate at one time by means of little daubers. The colour combination should follow in the same way as has been recommended for lithography. More beautifully coloured mezzotints would result if this system were adopted instead of the old one of using black.

An aquatint is similar to the above, only the roughened plate is made by rosin dust and is afterward etched. It is a cheaper method than mezzotint printing. A coloured etching can be made with a plate as in black-and-white etching, afterward cleaning the plate of black or brown ink, then daubing in flat colours as in mezzotint printing. I have found this method to be very successful both in printing the colours first and the dark lines afterward, and the reverse as suggested above.

A monotype is painted as in oil painting on glass and transferred to paper. Every impression must be from a separate painting on the glass. This art can be greatly developed with correct colour combinations.

CHAPTER THIRTEEN: COLOUR AS APPLIED TO INTERIOR DECORATION

WE DECORATE our homes so that we may enjoy the use of that part of the house for which it was designed, whether it be a dining room, sleeping room, living room, or kitchen. The colours used in the decoration must be so arranged that they will be agreeable to the occupant. The designer of a decoration whose only claim is that it is historic is to me a mere poseur, a hero worshipper, or an antiquarian. Individuality and originality in good taste are worth much more than a slavish pandering to the styles of long ago. One should live in the present, and make history in decoration. Although we may admire what some of the old master decorators have done in the past, let us not be so foolish as to cry with those who have no originality themselves, "The past holds the best in all the arts."

Many of our fine and applied arts are to-day at a higher stage of development than history records. So let us design to make the future history of decoration something that our children can look back on with pride and try to do better themselves and so progress.

The decorator should find out what colours or colour combinations are agreeable or disagreeable to his client before decorating a home. In Chapter XI, "Psychology of Colour," I have tried to explain why certain colours affect people differently. Individuals should be studied so as to make their homes characteristic of them. Some of our *nouveaux riches* have a better soul than most of us give them credit for. Let the decorator find this and not try to show his own character in his decorations. The soul of a Chippendale in the home of a Cromwell is hardly to be desired.

There are some general principles in decorations which should always be observed. Floors should always be the darkest part of a room and the walls a little lighter in tone and the ceiling still lighter. This is done to give a feeling of balance and follows the law of nature outdoors. The inside of a home is but the setting in which persons who inhabit the house are to be placed, and if the persons are themselves full of colour, care should be taken to see that the surroundings will fit in with their personality as well as with their ideas.

The cost of decoration has nothing to do with the good taste displayed. Sometimes with a small amount of money the best results are obtained. Simplicity is the highest form of art. Plain coloured walls or self-patterns are the best. If any design is used the same pattern should be repeated more

than once and not a number of different designs in the same room. The design should be unobtrusive, especially when there are to be pictures. A few modern decorators make no allowance for the display of our wonderful native art, and if this senseless idea were allowed to grow it would mean the killing of our fine arts, acting as a boomerang to the ultimate injury of our applied arts. Of course some persons prefer mural decoration instead of framed pictures but a little of both constitutes the best form of decoration. Certain rooms, like a formal drawing room, would be better with mural decorations, but a living room is more comfortable and less formal with a few pictures expressing different ideas.

A few suggestions for colour for various rooms may prove helpful. Many will prefer entirely different schemes of colour, yet each individual can find a combination pleasing to him or her by following the system as explained in Chapter IV, "Colour Combinations."

Large masses of colour are very often more pleasing in neutralized tones and brilliant colours in small masses. A bedroom, to be restful, soothing, and quieting, for a young girl, should be in a harmony of three colours, light in tint, or a tint of C or D in Colour-Mixing Charts. A woman's bedroom should be of a little darker colour and perhaps a combination of three colours against one or four against one, B or C in Colour-Mixing Charts. For a man's bedroom the colour could be darker still and in more neutralized tones, such as 3-B or 3-C in Colour-Mixing Charts. Whether a person likes red or blue or purple or green is immaterial so long as the combination of the other colours is in good taste. A bedroom should not be too brilliant in tone nor too complex in colour combinations. Violent colour combinations are not conducive to sleep.

In a living room, for winter, perhaps darker, warmer tones in harmony should be used, or five colours with one complementary in say 2-A in Colour-Mixing Chart. For the summer, light brilliant colours, such as, O or 1-A or B in Colour-Mixing Chart, and the combinations can be more bold, such as three colours with three complementaries.

For a smoking room dark neutralized colours, such as 3-A or 3-B in harmony, or five colours against one complementary; for example, red, orange, yellow, yellow-green, green with the neutral complementary violet, in 3-A as explained in Chapter IV, "Colour Combinations." Any set of colours based on the same principle would be in good taste, although one may prefer a warmer or more simple combination.

If the dining room is large and the owner prefers darker colours, it is best,

in order to give it a tone of simple elegance, to use three colours in 2-A with two complementaries, 1-A, the latter to be used in small quantities; for example, purple, crimson, scarlet, all 2-A. The colour of the furniture (mahogany), the walls in the same colours mentioned above relieved with pictures, the principal colours of which are hues between yellow-green and green and those between green and blue-green on Spectrum Chart—these colours should be repeated in upholstering of chairs, and the rug should be about the same colour as walls and pictures combined in simple pattern. If, however, the room is small, more brilliant colour can be used, especially if the room is a breakfast room. In that case O-B or O-C of four colours with their complementaries give a refreshing feeling and stimulate one in the morning. Another combination of colour that pleases many people is mahogany or walnut furniture with neutralized gray walls about the tint of D in Colour-Mixing Chart, with one colour such as blue-green, 1-A or purple 2-A. This would be a monochrome or one colour with its complementary.

A billiard room can be decorated in brilliant colours with very happy results as the cloth is itself a brilliant green (generally O-A in Colour-Mixing Chart). We should make our colour scheme conform to this green. One example, which I have found to be very successful, is to paper the walls in a blue oatmeal paper, slightly neutralized 1-C. The woodwork, including side benches of heavy design to conform to the lines of the table, should be neutralized violet 2-B with edges of green O-A like the brilliant cloth. The table itself should be painted the same colour as woodwork. The rug should be a neutralized blue-violet 2-A with O-A green and blue border in flat, square designs. The short window curtains can be green O-A and on the walls posters of brilliant colours, the principal hues of which are yellow, orange, red, scarlet, crimson, the frames being the same as the woodwork. The lamps should be vert antique on copper (blue-green) and the shades of glass of the same colour. The cues, hung on the wall, give another decorative unit of yellow and yellow-orange. So you see the billiard room need no longer resemble a "beer saloon" but can have the spirit of life and gaiety of a room that customarily is very dull in colour. The combination suggested, it will be noted, is in five colours with their complementaries, some neutralized, some brilliant.

Halls are usually dark, so it is well to decorate them in light, simple colours, sometimes in harmony of three, O-D in Colour-Mixing Chart. Yellow, yellow-green, and green is a good combination, or blue-green, blue, blue-violet, and white. Sometimes one wants dark hall furniture and woodwork of neutral-

INTERIOR DECORATION IN SPLIT COMPLEMENTARIES OF FIVE AGAINST ONE

Green, blue-green, blue, blue-violet, violet
Red

By MICHEL JACOBS

STAINED-GLASS WINDOW BY LLOYD COE

FASHION CATALOGUE ILLUSTRATION

PLATE XLI-A

ized orange, 3-A (dark oak) with walls of yellow and yellow-green, O-D or 1-D in Colour-Mixing Charts. The rugs and stair carpet could be a more neutralized tone of the same colours.

In the kitchen and bathroom it is better to use white with one colour as a monochrome, such as blue O-D, in Colour-Mixing Chart, in very small quantities.

CHAPTER FOURTEEN: COLOUR AS APPLIED TO COSTUME DESIGN

THE clothes that we wear have an important effect on our own character as well as on the character of those with whom we come in constant contact. Have you ever observed the behaviour of the small boy when he is dressed for a particular occasion? It is quite different from his attitude when he is wearing his everyday suit. A man or woman in evening clothes feels in a more festive mood.

Colour in clothes also affects our character. The cause and effect of colour have never been sufficiently studied. As in Interior Decoration, the colours chosen for one's personal adornment must express the taste of the wearer rather than the taste of the particular couturière or tailleur, or the mode of the moment, although, of course, a fashionable dressmaker will see that the clothes suit the client both in character and style. One is not always the best judge of what is the correct colour combination for his or her particular type though able to design for others. As Bobbie Burns so well said,

O wad some Power the giftie gie us
To see oursels as ithers see us!
It wad frae monie a blunder free us,
An' foolish notion:
What airs in dress an' gait wad lea'e us,
An' ev'n devotion!

In these pages a method for choosing colour combinations is given based on this system, with a few general examples.

It is axiomatic that it is much simpler for a man to dress well than it is for a woman. Men are bound by styles that change very little, although a man should be careful to see that his shirts, neckwear, hosiery, and gloves follow a general colour scheme. In my opinion, I think the best colour scheme is a monochrome, that is the same colour throughout, or perhaps a harmony of three colours in small patterns and, very seldom, brilliant tones. Colours that are neutralized in 1 to 3 in Colour-Mixing Charts, and in any one of their tints, make a harmonious combination. It is better not to use any of the tints of O shade, except for light summer wear.

For a young girl the following table of colour combinations has been arranged for different occasions and it has been purposely omitted to state to what part of the costume the colour is applied, since in this book the author is endeavouring to give colour and not design. It will be necessary, of course, to refer

many times to Chapter IV, "Colour Combinations," in order to understand the many combinations in good taste possible by this system.

Negligée: Light and delicate colours; harmonies with 3, 4, or 5, or three colours with one complementary; tones from O to 3; in tints B, C, and D. *Example:* for a blonde: green, blue-green, blue in 2-C with blue-violet and violet design in O-B.

Morning Dress: For winter, darker tones of harmonies of three colours, or one colour in a number of tones with one complementary. Tones 1, 2, 3, in tints A or B. *Example:* for brunette: red and orange 2-A with pattern or trimming in yellow 1-A.

For summer, lighter harmonies of three or four colours or two colours with one complementary. Tones 1, 2, 3, or 4, in tints B or C. *Example:* for brunette: orange, yellow, yellow-green 1-B.

Sport Clothes: For spring, summer, and autumn, for a very young girl the colours can be very brilliant in yellow, yellow-green, green, blue-green, blue, blue-violet, or violet O-A; for a woman the colours should be more neutralized, 1 or 2-A or B in Colour-Mixing Charts.

For winter, warmer colours should be used, such as red, scarlet, crimson O-A. If the brilliant colours are used it would be well to have but one colour with two or three shades of that colour in smaller quantities. *Example:* for an auburn-haired girl: violet sweater O-B with skirt of 3-A, same colour, trimmed with O-A, same colour. Tam o' Shanter of O-D same colour.

Street Dress: For winter and late fall, darker neutralized tones 1, 2, or 3-A in Colour-Mixing Charts. The combination should be harmonies of three or four colours with one complementary. *Example:* for brunette with medium brown hair: purple, scarlet, and crimson neutralized 3-A, trimmed in small design with green (emerald) neutralized 1-A. Gloves neutralized purple 3-A; shoes and stockings black. Hat, combination of purple, crimson, scarlet 2-B with small trimming of green 2-B.

For summer colours can be brighter and lighter in tone, 1, 2, and 3 in B or C. *Example:* young woman with prematurely gray hair; blue-green, blue, and blue-violet, neutralized 3-D, trimmed with small design in red 2-B.

Afternoon Dress: Colours can be a little more brilliant than for street wear and of greater variety. Combination of four colours with one complementary or three colours with two complementaries. Body of the dress should be neutralized 1, 2, or 3-A, B, or C, in Colour-Mixing Charts,

with complementary colours in more brilliant tones than the larger masses of colour. *Example:* young girl with black hair, dark complexion, and very little colour in face: a dress of soft material in neutralized orange, yellow, and yellow-green 2-B, relieved with trimmings such as narrow piping of yellow-green 1-A and chiffon collar, cuffs, or ruching, in colours between blue-violet and violet, neutralized 3-A, and a colour between violet and purple neutralized 3-A.

Dinner Gown: This dress is generally worn with a few jewels and it is necessary to consider the colour of the stones in relation to the gown. One might call this dress a semi-ball gown and therefore the colours can be fairly brilliant either in harmonies of 3, 4, 5, or 6, or four colours with 1 or 2 neutralized complementaries generally in 1- or 2-A or B. *Example:* young girl with extremely light, flaxen hair, with delicate complexion and high colour: colour of dress in blue, blue-violet, and purple neutralized in 1-A with small pattern of trimming in crimson O-A.

Ball Gown: As this costume must suggest the use to which it is to be put, the ball gown may be brilliant in colour, either in light, or darker tones, and can be of any tone or tint in Colour-Mixing Chart. Sometimes it is desirable that a ball dress be in light, sometimes in dark colours. In either case the combination can be in harmonies of 4, 5, or 6, or three colours and their complementaries. For a young woman with reddish brown hair, fair complexion, and good colour, purple, crimson, scarlet neutralized 2-B in Colour-Mixing Chart, with chiffon trimming in yellow-green, green, blue-green neutralized 3-A, small design trimming such as ribbon flowers in all colours used. Stockings should be neutralized crimson 2-C with gold or bronze slippers.

The suggestions made in the foregoing are only to convey to the reader an idea of the adaptability of the Colour System. Combinations can be made by using the same system for any costume desired.

FASHION CATALOGUE ILLUSTRATION SHOWING SHADOWS GOING TOWARD THEIR COMPLEMENTARY

BATIK TIED AND DYED IN THREE COLOURS, YELLOW, BLUE, AND CRIMSON

PLATE XLIII

CHAPTER FIFTEEN: COLOUR AS APPLIED TO LANDSCAPE GARDENING

N THIS art one has great power and freedom, for here we deal with nature's own tools and mediums. Unlike painting with pigments, we have the colours to satisfy our æsthetic sense; brilliants, grays and whites that no paint-maker can imitate.

To lay out an Italian garden with its formally cut trees and flower beds, or to make the landscape a miniature wild hillside requires colour knowledge and taste.

Flowers can be combined in the same manner as described in Chapter IV. But perhaps it would be well to give a few suggestions as to trees and flowers as well as to the architectural details.

In arranging trees it is necessary to know the colour of the foliage in all seasons, when seen from a distance. For example, a maple tree changes its colour from yellow-green at first to yellow and then to red as the season advances, whereas the birch changes only to a yellow. If we decide to make a certain part of our garden in a harmony of yellow, yellow-green, green, blue-green, and blue, we must use the trees which show these colours, such as the willow, birch, beech, poplar, cedar, and blue pine. Then as the season advances there would be a harmony of warm tones, and the effect is more than charming when the colours of the harmony are arranged in sequence as in the Spectrum Chart. The colour of any statuary or other ornamental work should be green bronze or white marble because a warm-coloured bronze or a dark stone would destroy the harmonious effect.

Perhaps we wish to make a dreamland vista of seeming great distance. Let us then plant the yellow-greens in the foreground and the blues in the distance. This will increase the distance, especially if our light colours are farther away. White birch trees in the distance give the effect of fairyland and if we place marble statues at the end of a tree-lined lane we have completed the picture.

Sometimes we wish a spot of red against blue to accentuate a certain part of our land. Blue pines in the distance with red oak in the foreground will do this. Sometimes a natural coloured bronze will give us the effect, or sometimes a piece of red marble. It is not only necessary to find the rock to make a rock garden, it is also necessary that the rock be of the right colour. Different textures require more or less contrasts; flowers in harmony, rocks in another harmony, and each complementary to the other as described in Chapter IV.

A flower garden that is beautiful just because it has wonderful flowers in it will be much more beautiful if those flowers are arranged in sets of harmony against other sets of harmony. For example, arrange roses so that the deep

crimson rose melts into a scarlet, then into a red rose, and from a deep orange-coloured tea rose to a lighter yellow, and then to a white. On another bed a series of violet, blue-violet, and blue flowers can be arranged. Perhaps we wish to show our red flowers in all their gorgeousness. Let us then place as a background a screen of blue flowers or trees. Designs can be laid out with many kinds of flowers in the same manner as given in Chapter IV, "Colour Combinations."

Following is a brief list of flowers that bloom in spring, summer, and autumn with their approximate colour in the Spectrum Chart. By using this list in conjunction with "Colour Combinations," Chapter IV, a garden that is pleasing to all can be laid out in any colour combination for every season.

Note: "L" indicates "light" in colour; "D" dark. Where "L" and "D" are both used it is because the flowers bloom both light and dark. "W" indicates white and the other colours according to the first letter used.

SPRING

	W	R	O	Y	YG	G	BG	B	BV	V	P	C	S
Achillea Ptarmica	*												
Aquilegia chrysantha				L							L	L	
Arabis	*												
Aubrietia											L D		
Bloodroot	*												
Crocus	*		D	D				D	D	D	D		
Daffodil			D	L D									
Daphne odorata													L
Deutzia lemoinei	*												
Dogtooth Violet	*			L D						L D	L D		
Feverfew	*												
Forget-me-not	*							L					L
Mertensia Virginica								L D					
Muscari	*							D					
Narcissus	*			L D									
Nemesia								L					
Pansy	*		L D	L D				L	L D	L D	L D	L D	L D
Peonies	*									L	L D	L D	L D
Primrose				L						L			
Puschkinia										L			
Rhododendron	*									L D	L D	L D	L D
Scilla Sibirica	*							L D	L D				
Snowball	*												
Snowdrop	*												
Spirea	*									L			L
Thrift	*												L

SPRING—*Continued*

	W	R	O	Y	Y G	G	B G	B	B V	V	P	C	S
Viola	*			L					L D	L D	L D		
Wistaria	*								L				

SUMMER

	W	R	O	Y	Y G	G	B G	B	B V	V	P	C	S
Acidanthera bicolor	*												
Aconite									D				
Ageratum	*								L				
Althea	*									L D			L
Alyssum	*			D									
Anchusa Italica								L					
Anemones, Japanese	*										L		
Antirrhinum	*	L D	L D	L D								L D	L D
Baby's Breath	*									L			
Balsam	*		L D					L D	L D	L D		L D	L D
Begonia	*	D	L	L									L
Bleeding-heart													L D
Buddleia										L			
Calendula			D	D									
Camomile				L									
Campanula	*							L					
Candytuft	*									L D	L D		
Canterbury Bell	*										L D		L
Clarkia elegans		L											
Clematis	*										D	D	
Cosmos	*									L		D	L

SUMMER—*Continued*

	W	R	O	Y	YG	G	BG	B	BY	V	P	C	S
Dahlia	*	L D	L D	L D						L D	L D	L D	L D
Daisies	*		L	L					L				
Delphinium	*							L	D				
Dianthus	*									L D	L D	L D	L D
Eryngium								L					
Foxglove	*			L						L D	L D		
Funkia	*									L D	L D		
Gaillardia		L D		L D									
Galtonia	*												
Geranium	*	L D										L D	L D
Gladiolus	*	L D	L D	L							L D	L D	L D
Montbretia		L D											L D
Mullein				L									
Pentstemon	*												L
Petunia	*									L D	L D		L D
Phloxes	*									L D	L D	L D	L D
Physalis		L											
Physostegia	*										L		L
Pink	*											L	L
Platycodon	*							L D	L D				
Poppy	*	L D	L D									D	L D
Pyrethrum	*											D	D

SUMMER—*Continued*

	W	R	O	Y	YG	G	BG	B	BV	V	P	C	S
Rose	*		L	L								L D	L D
Salpiglossis		L	L	L								L D	L
Salvia		L											
Scabiosa Japonica										L D	L D		
Sea Holly										L D	L D		
Shasta Daisies	*												
Snapdragon	*	L D	L D	L D								L D	L D
Stachys Lanata										L			
Statice										L			
Stock	*									L D	L D	L D	L D
Stokesia	*							L					
Sunflower		L	L D	L D									
Sweet Pea	*	L D	L D					L D	L D	L D	L D	L D	L D
Sweet William	*	L D								L D	L D	L D	L D
Syringa	*												
Thermopsis Carolinian			L										
Tritoma		L D	L D										
Tulip	*	L D	L D	L						L D	L D	L D	L D
Verbena	*									L D	L D	L D	L D
Veronica										D			
Yucca	*												
Zinnia	*	L D	L D	L D						L D	L D	L D	L D

AUTUMN

	W	R	O	Y	Y G	G	B G	B	B V	V	P	C	S
Aster	*							L D	L D	L D	L D	L D	L D
Bittersweet		D	D										
Chrysanthemum . . .	*	L D	L D	L D							L	L D	L D
Michaelmas Daisy . . .	*							L D		L D	L D		L D

WINTER

	W	R	O	Y	Y G	G	B G	B	B V	V	P	C	S
Camelia Japonica (Hothouse)	*												L
Cineraria (Hothouse) . .	*								L D	L	L D	D	

CHAPTER SIXTEEN: COLOUR AS APPLIED TO CUT FLOWERS

IN ALL nature there is nothing so ravishing as the great variety of colour seen in flowers. Who has seen the American beauty rose and not felt exhilaration, an elevating influence? But the colour of flowers in combination can be either pleasant or unpleasant. This system is adapted to the arrangement of flowers both for the florist and for the home, for cultivated or for the flower wonders of the field.

The preceding chapter on "Colour as Applied to Landscape Gardening" will be found of use also in the arrangement of flowers, but as cut flowers are more personal than are large masses growing in the garden it is well to remember not to make the combination too violent. The harmonies for personal adornment will be found to be more pleasing. The combinations will be found in Chapter IV, "Colour Combinations."

For vases of flowers one can make the combination of complementaries; such as, four adjacent colours with two complementaries or five colours with one complementary.

When arranging flowers in the home, the colours that are used in the decorations of the furnishing should be taken into account, so that the flowers displayed either be in contrast or in harmony, as explained in the chapter on "Colour Combinations." If we have a dark corner of a room that has no permanent decoration and is uninteresting, a vase of flowers in contrast to the colour combinations will increase the beauty of the entire room.

When winter comes we can secure at the florists numbers of dry or embalmed flowers, autumn leaves, or even painted poppy bulbs or lily pods, which, if arranged in good colour combinations, will make the home more attractive. The drapery in the immediate vicinity must be taken into consideration with the colours of the flowers themselves.

A good interior decoration can be enhanced or marred by the selection of the proper colours of the cut flowers which are placed in the room.

One should always remember that the green of the foliage must also be taken into account as one colour and the vase as another, and care should be taken to see that the decoration of the room or the gown one is wearing will make a correct combination. If this is followed closely you will be able to see your favourite flowers as you have never seen them before.

CHAPTER SEVENTEEN: COLOUR AS APPLIED TO WEAVING OR TEXTILES

IN THE weaving of silks, linen, wool, or cotton there is the advantage of unity by weaving colours, one with the other, without losing brilliancy. Here colour juxtaposition can be carried to the highest degree. The colour combinations in the masses or designs should follow what has been laid down in Chapter IV, "Colour Combinations." In the present chapter I shall suggest some possible combinations to be arrived at by the woof or filler and warp of the cloth.

Combination of Primaries: If we take a brilliant emerald-green thread and cross it with a brilliant violet in half and half proportions; i.e., if our woof and warp have the same number of threads of the same size, we will have a brilliant blue cloth. This can be shaded into the blue-green and blue-violet by increasing one or the other of the two threads to the surface of the cloth. We can make our designs in blue, green, or violet, and shades between these on the Spectrum Chart by the same process of dropping the warp and allowing the woof to show in the shape of the design. If we drop the warp and show the woof or filler the design will be violet, and if we allow only a few threads, say one in four, of the warp to show we will have a blue-violet design. One can readily see how many combinations are possible with only these two colours.

If we have red and green threads and use them in the same manner there will be a combination of red, yellow, and green, and all the shades between on the Spectrum Chart. Red and violet will give us red, crimson, and violet, and all the shades between. Crimson and yellow will give us crimson, red, and yellow, and all the shades between. Yellow and blue will give yellow, green, and blue, and all the shades between. Blue and crimson will give blue, violet, and crimson, and all the shades between.

We have seen by the admixture of any two spectrum primaries or any two pigmentary primaries how we can make many hues. If we take two of these combinations in our weave we will have many more than just double the number of shades; for example, if we use a violet and green with a yellow and crimson we have monotones that appear violet, blue-violet, blue, blue-green, and yellow, orange, red, scarlet, and crimson, and where the yellow thread is in juxtaposition with the green we have yellow-green; where it crosses the violet we have a neutralized gray. An excess of violet gives us a neutralized violet and an excess of yellow gives a neutralized yellow. When yellow crosses both the violet and green the result is another shade of green with much

scintillation, and if there are three violet threads showing and only one green and one yellow, the result is a neutralized blue-violet of wonderful vitality. If crimson crosses violet there is purple, and if purple crosses yellow and green there is a neutralized purple. One can see how many combinations are thus produced. If more than two sets of primaries together are used the possible combinations are innumerable.

Triads: If we use three colours; that is, one third of the spectrum, we can weave a cloth with all the colours; some a little neutralized, it is true, but with red, green, and violet we can make yellow, blue, and crimson, and in the reverse way, yellow, blue, and crimson produce red, violet, and green. The green in this last mixture will not be an emerald green and the red and violet will be a little lower in key, but they will have the added charm of vibration. White added to any of these combinations will of course make a lighter tint and black a darker shade.

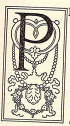
Harmonies: In Chapter IV, "Colour Combinations," the reader is told how to make a harmony in three, four, five, and six colours, but if we weave only two adjacent colours in Spectrum Chart, we must produce a shade between them, which would make the cloth in harmony; i.e., if we weave yellow with yellow-green, we make a green-yellow by this mixture, and if our design is yellow and the body yellow-green, the half tones are green-yellow. But if instead of using the yellow-green we use green, we will have a more complete harmony and greater life in the textile.

White or black also can be used in any harmony weave without affecting the harmony.

Of course, monochromes are used by combining one colour with black or white.

Fabric designs (Plate XVI).

CHAPTER EIGHTEEN: COLOUR DYEING AND BATIK



PERHAPS there may be a few readers who do not understand exactly the making of a batik, and it might be well to explain here, in as few words as possible, really what a batik is.

Java seems to have been one of the foremost nations in the dyeing of cloth with figures and patterns in design dyed into cotton and silk; and the Japanese seem to have carried it even to a greater art. Cloth, from time immemorial, has been imported into Java from Holland and England, and was chiefly a calico used by the natives as garments and head-dress. Pieter Mijer has written an excellent book in which he explains fully how to make dyed batik.

It is the object here simply to give the colour combinations that are possible and the effects that can be obtained by the combinations of colours, as very often the amateur batiker trusts to luck to get an effect, and until the cloth is completed has not the remotest idea of the colours that will be produced.

In a brief way, the following is the method used: A pattern is drawn on the material with a soft pencil or crayon, the cloth is then waxed with an instrument which is called "tjanting" which is made in different shapes. Only the portions are left exposed which are intended to be dyed in the first dyeing. After the dyeing the wax is removed, and the portions which have been dyed are waxed to protect them from the next dyeing. This method of waxing is repeated many times where there are many colours, but as I have explained in the first part of this chapter, many effects can be secured by dyeing one colour over parts of the material already dyed one colour, instead of using numbers of different dyes. As Mr. Mijer says in his book, "Many batiks are simply painted cloth." Without using the wax the colour is painted with a brush in the pattern desired. Of course, the colour will run in uneven forms if put on the cloth with water only, but the author has found that it is possible, by stretching the cloth very tightly over a chalk surface, for the dyes to be kept within reasonable bounds, as the excess of moisture will be absorbed by the underground of chalk. He has also found that an ordinary waxed pencil can be used instead of the melted wax in the tjanting.

Another method is by tying with a string small particles of the cloth, and dyeing them in different colours. This allows the dye to make fantastic patterns which are sometimes very interesting; but of course this method of design is purely accidental.

After the cloth has been dyed in the pattern and colours desired, sometimes it is found advantageous to cover parts, or the entire cloth, with a crackle.

This is done by mixing portions of beeswax and paraffine, and dipping the cloth in this. When this wax mixture has become hard on the cloth, it is crumbled in the hand; so that the wax will break into fine cracks, and afterward by dipping the cloth in dye of a darker colour than the pattern, the cloth will have a network of cracks in the parts which have been exposed to the dye. The Japanese use this "crackle" to a greater extent than the Javanese. In fact, some fabrics are dyed only with the crackle in different colours. This is done by waxing, crackling the wax, and dyeing in one colour, re-waxing, crackling the wax again, and dyeing in another colour. The writer has made some cloth by this Japanese method which has been found to be very interesting, and entirely different from the batik cloth generally done in this country.

Many excellent books have been written on colour dyeing and batik, but in all that one reads none gives a comprehensive and exact method of mixing dyes to secure the most brilliant colours such as were used and understood by the ancients. Of course, combinations of colours have much to do with the effect of brilliancy as described in Chapter IV, "Colour Combinations." Outside of the juxtaposition, colour mixing as given in Chapter III is most important. There is a slight difference between mixing dyes and mixing paints. In mixing dyes there is the added advantage of mixing aniline dyes by both the spectrum and the pigmentary law of colour, for the reason that cloth may be held up to the light or used to reflect the rays of light. Therefore we may mix an emerald-green dye with a red vermilion to secure a brilliant yellow. Further, we can mix violet with red and secure a brilliant crimson. This is impossible with paints except in the juxtaposition method.

By using the Spectrum Chart, Fig. 1, combinations of colours can be used either in harmony or in contrast (see Chapter IV).

For example: if a cloth is first dyed yellow, then crimson, we can produce any of the hues between these colours in the Spectrum Chart by using more or less of one or the other colour and allowing the cloth to stay in a weaker or stronger solution. Certain parts of the design can be made blue-green, green, or yellow-green over the yellow parts that have been covered with wax before dipping into the crimson solution. These would all be brilliant colours, and if it is desired to make a pattern superimposed, such as a crackle over all in a neutralized colour or black, it would be necessary to leave exposed only the parts to be so superimposed and dyed a complementary to the centre colour arrived at by the triple dyeing. In this particular example it would be violet.

A safe rule to follow is that all colours within six on the Spectrum Chart can

be produced together without lowering their brilliancy, and if it is desired to get neutralized colours, use their complementaries as described in Chapter IV.

While it is possible to get a very dark gray by using complementaries, it is sometimes found desirable to use black in conjunction with two complementaries. By this method we get a deeper, richer black than by using black only. The idea of mixing red with blue to produce a purple, and the same red with yellow to produce an orange, or the blue with yellow, to make green as some books on batik describe, will not give the most brilliant results. The colours spoken of in these books as secondaries and tricendaries or tertiaries would place colour dyeing in the same category as the old school of painting which is sometimes known as "Brown Sauce."

It seems that the batik art is still using the old colour theory of Newton and Brewster, ignoring the laws of nature as discovered by Helmholtz. Red, yellow, and blue are not the primary colours but red, green, and violet are known by all scientists really to be the only colours in nature as explained in the first chapter of this book. Such colours as red-brown, blue-brown, green-brown, and orange-brown are nothing more or less than red mud, green mud, blue mud, and orange mud.

Of course, one does not always wish to use brilliant colours in the dyeing of cloth. However, we certainly do wish to have our fabrics pure in colour whether they are dark gray or lighter neutralized tones. The dyer will be greatly surprised when he or she tries the system as advocated in this book, at the simple process of using complementary colours to make neutralized tones and making colour combinations in conformity to the chapter on that subject, following the formula given in Chapter III, "Colour-Mixing," paying particular attention to the test therein given as to what is a perfect yellow, a perfect crimson, or a perfect blue.

CHAPTER NINETEEN: COLOUR AS APPLIED TO STAGE LIGHTING AND DESIGN

THE stage is an animated graphic art. On it are displayed nature, real and unreal; themes that are objective and subjective; truths, myths, fables; ideas and ideals—all revealed to us through the media of language, action, form, and colour.

As I remarked at the beginning of this work, colour is the first instinct of a child and of a savage. It may be said to be meat to that part of the brain which is affected by the optic nerve. Therefore, if we wish to express our ideas to others by a basic sense we must understand the laws of colour—nature's laws—and how they affect the human eye.

In stagecraft we have the added power to make our colour change in hue, tone, and tint at will, by the use of coloured lights of varying intensity. We must therefore study not only colour mixing, colour juxtaposition, and colour combinations, but the effect of coloured lights on colour itself. It is possible to paint stage scenery so that by throwing different coloured lights on the scene an entirely different effect can be produced for the spectator by using the light complementary to the colours on the set. For example, in Plate XXII is a picture of an autumn scene. By covering with the red gelatine, the effect of a snow scene will be produced. This is because the picture is painted in scarlet, red, orange, yellow, and their complementaries—blue, blue-violet, and violet. The first three colours being in harmony to the red filter or gelatine, appear white, and the complementaries appear as grays of different shades. So the trees lose their foliage of yellow, orange, and red, and the tree trunks become bare. By closely studying this picture in daylight and under a red filter you will notice that this seeming phenomenon is also based on this same system of colour which is used in other arts. Many similar striking colour effects can be produced by using coloured lights that are in harmony.

If we paint a scene in green, blue, green-blue, and blue-violet, and throw a blue light on the picture it will disappear into a white mass, and if a red light is thrown on it it will become black. If an object were painted with any of these colours neutralized with their complementaries, as in Colour-Mixing Chart, the forms so painted would not be visible until shown under a blue light. The figure painted with any of the above neutralized colours would appear and everything would be white. Then if a white electric arc were used the figure would disappear. I first became familiar with these phenomena while developing this colour system in 1912, and later published it in the Montreal *Star* in 1913. Many novel effects can be developed along these lines, but the most

important part of these experiments is to show what wonderful results can be obtained by using the correct coloured light on the correct coloured set.

In designing a set, care should be taken that the colours used form combinations as explained in Chapter IV on "Colour Combinations," whether in high contrast or in low harmonies; and great care should be exercised to see that the lights and costumes are designed at the same time and in the same scheme. For example, if a set is to be designed to represent a garden scene, and five colours are used with three complementaries, the combinations must include the costume colours. These colours and their complementaries could be yellow, yellow-green, green, blue-green, and blue, either 0-B or 1-B, and the white used should be tinted with yellow. The costume could be white, light gray, purple, crimson, scarlet 0-B and 1-B in Colour-Mixing Chart. The scene can be changed from early morning sunlight to late night, and every colour be a beautiful combination by using yellow-orange light (intense) on the sunlighted side, and blue-violet (diminished) on the shadow side. As sunset approaches the yellow-orange is gradually changed into orange, and the shadow light into violet; then the sunlight into red, and the shadow light into purple. This would give the highest contrast to the sunlight, as explained in Chapter VIII, "Sunlight Outdoors and In," and gradually the intensity of the sunlight would be decreased as the sun set. Night throws a blue haze over all, gradually changing into neutralized blue-green to 3-A. Moonlight would be a blue-green light tint 0-D.

As I have said, the stage is an animated graphic art; the study of colour for it must necessarily follow the same system of colour which is applicable to all the other arts described in this book.

In the simultaneous combination of different coloured lights the following general principles will be found to apply:

If two complementary coloured lights are used on the same spot at the same time white light will be produced. For example, red and blue lights make white light. Of course, the colours referred to are the red and blue in the Spectrum Chart on Plate I. The parts of the stage lighted by only one of these colours would be red or blue.

If any two spectrum primary coloured lights are combined they make the pigmentary primary. Green and violet lights make a blue light; green and red lights a yellow light; red and violet lights a crimson; and in the reverse way a crimson light and a yellow light make a red light. A yellow light and a blue light make a green light and a blue light and a crimson light a violet light. The laws of this system as set forth in Chapter I apply here throughout. Two of

the pigmentary primaries of the Spectrum combined make the inverse order. Any coloured light thrown on a coloured pigment which is within a harmony of six, as explained in Chapter IV, changes the colour of the pigment but will not lower its brilliancy. Any two coloured lights that are complementary will tend to make the light white.

While two complementary colours in light will make a white light, it must be remembered that the object on which they are thrown must in itself be white to show this effect. If the object is coloured, the effect of the two complementary coloured lights will be to show the object up in its true colours under the white light.

If any coloured light is thrown on to the same colour pigment, and no other light is visible, all colours that are in harmonious sequence will appear white if no other colour is within the vision for comparison. This is, perhaps, a modified form of the known laws of relativity. A coloured chalk drawing on the same colour paper as the chalk itself will not be visible because there is no way by which the eye can see the relative colour value between the chalk and the paper. If it is desired to have a set of a sequence in harmony, such as crimson, scarlet, red, orange, and yellow, a red light thrown on this set when no other light is visible will be a perfect blank in so far as colour is concerned. If we have introduced any of the other colours of the spectrum which are complementary or nearly complementary to the light they will appear black or gray, but if we have other light visible to the eyes of the spectators they will become conscious, immediately, of the red colours painted in the set which will show much more brilliancy than if they had a white light on them. This is on account of the law of relativity.

A set may be lighted with one colour, the set being painted in harmonious sequence, and figures or objects which are of the same colour, complementary to the light thrown on the set may be introduced, and a spotlight thrown on to these persons or objects, which will show them up in very brilliant colour. This light, while itself may be complementary to the set, will have no effect on the colour of the set, but will only light up the objects which are coloured within the light's harmonious sequence. For example, a set may be painted in violet, blue-violet, blue, blue-green, and green, the light thrown on the set to be blue. A figure is introduced which is clothed in a vermilion cloak, and a red spotlight is thrown on to this figure. The set will in no way reflect the red light which is thrown on the figure, and the figure itself will in no way reflect the colour blue which is thrown on the set. This is because a colour will only reflect the coloured rays which are in harmonious sequence.

If the stage designer will but follow this system in the colour of sets, in colour of costumes, and the colour of the lights we would have colour effects much more wonderful and pleasing to the eye.

For the guidance of those who desire to try this system of stage lighting, I give a table of coloured lights on coloured pigments. Some of these effects are already known, I am aware, which have been found out by long experiments, and there are a great many more combinations possible which can not all be listed here, but I trust the table will be a guide.

One or two things should be borne in mind, the stronger the light the more intense can the gelatine screen be, but *we cannot get more of a coloured ray of light out of a lamp than it has in it*, that is, if the light is, say, a carbon filament lamp, we can get but very little blue light from it as it has very little of the violet rays of light in its composition no matter how dense we make the gelatine, whereas a Mazda-gas-filled lamp has a much greater proportion of violet rays, and we can get much more of the blue light through. It must be remembered blue light is made up of violet and green rays. There is a great deal of red rays in both kinds of light, and quite enough of the green. The only colour with which we will find difficulty, on account of the violet rays, is a brilliant blue; so if we do wish a set lighted brilliantly with a blue we must use many more lights than we would for any other colour.

Another thing we must remember is that we can only reflect from a pigmentary surface the colour in which it is painted or one of its components. You do not neutralize a colour with light of its complementary colour, it simply does not reflect its true complementary.

For example, a yellow will reflect a yellow light, and as its components are red and green it will reflect both of these colours. It will, therefore, naturally also reflect the hues between, yellow-green and orange.

The names of colours of the gelatines are taken the same as in the Spectrum Chart on **Plate I.** I understand that crimson is called magenta; and yellow, light amber; orange, dark amber, etc.; but I think it would be an advantage if the electrician called his colours the same as the artist who paints the sets calls his paints. It certainly would avoid some confusion. However, any one can translate these colours into the regular names now used by using the Spectrum Chart on Plate I.

It is suggested that you find out first just what proportion of each coloured ray your light has. This can be done by holding the Spectrum Chart, on page I, up to the light, and if any colour does not show up as brilliant as it does in daylight you know it has less of that coloured ray.

LIGHTS

PIGMENTS

	Red	Orange	Yellow	Yellow-Green	Green	Blue-Green	Blue	Blue-Violet	Violet	Purple	Crimson	Scarlet
Red	White	White	White	Blue-gray	Blue-black	Blue-black	Blue-black	Blue-black	Blue-black	Red-gray	White	White
Violet (a fluorescent)	Brilliant Crimson	Brilliant Scarlet	Brilliant Orange	Green	Blue-green	Blue-Blue-green	Light Violet-blue	Light Blue-violet	Violet	Dark Crimson	Brilliant Crimson	Brilliant Crimson
Green	Very Neutralized Red	Very Neutralized Red	Green-yellow	Gray	Light Gray	Light Gray	Gray	Dark Gray	Dark Gray	Neutralized Purple	Black	Very Neutralized Scarlet
Yellow	Red	Orange	White	Green-yellow	Slightly toward Yellow-green	Green	Neutralized Yellow-green	Moon Neutralized Yellow-green	Black	Neutralized Crimson	Scarlet	Red
Blue	Black	Dark Neutralized Orange	Green-yellow	Green-gray	Blue-Green-gray	Green-Blue-gray	Light Blue	Light Blue	Blue-violet	Violet	Purple	Crimson
Crimson	Brilliant Orange	Orange	Yellow-orange	Gray	Black	Neutralized Blue-violet	Bright Blue-violet	Brilliant Violet	Brilliant Purple	Purple	Light Crimson	Red
Red with Violet	Red	Red	Yellow-orange	Dark Yellow-green	Blue-green	Green-blue	Blue-violet	Violet-Blue-violet	Violet	Purple	Crimson	Scarlet
Red with Green	Red	Orange	Yellow	Yellow-green	Green	Green-Blue-green	Dark Blue-green	Dark Neutralized Blue-green	Black	Neutralized Crimson	Neutralized Scarlet	Slightly Neutralized Red
Violet with Green	Scarlet	Red	Yellow	Yellow-green	Green	Blue-green	Blue	Blue-violet	Violet	Purple	Light Crimson	Crimson
Violet with Blue	Scarlet	Red	Yellow-orange	Yellow-green	Green	Blue-green	Blue	Blue-violet	Violet	Purple	Crimson	Brilliant Crimson
Blue with Yellow	Brilliant Orange	Orange	Yellow-Yellow-orange	Neutralized Green	Blue-green	Blue-Blue-violet	Blue-violet	Violet-Blue-violet	Purple	Purple	Crimson	Red
Crimson with Yellow	Red	Orange	Light Yellow	Yellow-green	Slightly toward Yellow-green	Blue-green	Neutralized Blue	Blue-violet	Purple	Purple	Crimson	Scarlet
Yellow-Light Green	Red	Orange	Yellow	Yellow-green	A little Yellow-green	Green	Green-blue	Blue-Blue-green	Neutralized Purple	Purple	Crimson	Scarlet
Blue with Green	Neutralized Red	Neutralized Yellow-orange	Green-yellow	Blue-green	Green	Blue-green	Blue	Blue-Blue-violet	Blue-violet	Violet-purple	Purple	Crimson
Violet with Crimson	Brilliant Scarlet	Brilliant Red	Orange-yellow	Neutralized Green	Blue-green	Blue	Blue-violet	Neutralized Blue-Violet	Brilliant Purple-violet	Brilliant Purple	Crimson-purple	Red
Crimson with Red	Yellow-orange	Yellow-orange	Yellow-orange	Very neutralized Red	Black	Black	Blue-black	Blue-black	Purple	Crimson-purple	Crimson	Red-orange
Red with Yellow	Red	Orange	Yellow	Green-yellow	Green	Neutralized Green	Dark green	Black	Neutralized Purple	Neutralized Crimson	Crimson	Scarlet

As all gelatine is dyed with aniline dyes there is a florescence which gives it the quality of being able to let two rays pass at the same time. Violet or purple gelatine is very marked in this respect.

The lighter the coloured pigment the more it will reflect other rays besides its own, especially the colours near to it in the Spectrum Chart.

Plate XXII—Coloured Lights on Pigments.

When the sets are lighted from back stage the light thrown toward the audience will not be changed in the intensely lighted part, but as the rays go away from the source of light they will blend into the lights thrown on the set from the front. In this way many beautiful iridescent effects can be produced.

CHAPTER TWENTY: PRACTICAL COLOUR FOR HOUSE PAINTERS

THE journeyman painter is interested in colour because usually he does not know how to mix his paints to produce certain tones and tints. He is, of course, hampered by being compelled to use a cheaper grade of paint than the artist uses. He is also interested in knowing what colours will go well together. For this he is referred to Chapter IV, "Colour Combinations," for the general principles are the same wherever colour is used. He is advised to study this chapter thoroughly and to understand what is meant by Colour Harmonies, Colour Contrasts, and Colour Complementaries. He will find that his customers will like any of these combinations provided they desire harmonies or contrasts as explained in Chapter XIII, "Interior Decoration."

Concerning colour mixing, he can use colours already mixed to nearly the colour he wishes, but if the tone is to be altered he must add a little of the pure colour he wishes to approach. The mixture of complementaries is too expensive for house painting, and the painter must use black to neutralize his colour. If he is careful of which black he uses he will injure the purity of his colour much less than if he does not observe this precaution. For example, if he wishes to lower the brilliancy of violet, blue, or green, let him use blue-black, and if he wishes to lower the colour of purple, crimson, or scarlet, let him use jet-black; and if red, orange, or yellow, let him use Vandyke brown or ivory black, adding as much white as will make the desired tint. If he uses blue-black to try to lower a red, let us say, he will change the red into a neutralized purple. If he uses jet-black with blue he will change it into a neutralized blue-green. If he uses ivory black with blue he makes a neutralized yellow-green. If he uses ivory black with green he changes it into a neutralized yellow-green. Therefore a painter should know just what colour will result by the mixture of any black, recognizing what hue the black is. This can be determined by mixing the black with a little white, remembering, however, that most whites have a little blue in their composition to neutralize the yellow-orange colour of the oil; or in water colour, the colour of the binder used. Unfortunately, even some artists still use black in mixing their colours regardless of the foregoing, and the result is their pictures are far, very far, from the colours of nature.

By using the Colour-Mixing Chart the painter can show his customer any colour that he is able to mix.

First, mix the pure colour to be used, then add the right black, allowing for

the colour of the oil or binder, adding sufficient white to make the desired tint. In this way many pounds of paint will be saved and a much more beautiful colour will result.

To find out what certain colours are—such as, raw umber (a very neutralized yellow); burnt sienna (a neutralized red), turn to Chapter XXII, "Dictionary of Colour."

CHAPTER TWENTY-ONE: COLOUR IN RELATION TO MUSIC

NUMBERS of books have been written on the relation of colour to music. There is, of course, an analogy between the two arts which is based on the similarity of emotion created by beautiful colour and beautiful sound. Our sub-conscious self, our soul, can be elevated to the heights of the seventh heaven by the elation of rhythmic sounds or harmonious colour combinations. It is on account of the analogy of the two emotions that many have promulgated the idea that sound and colour can be expressed at one and the same time, and that therefore by their simultaneous employment we would derive enhanced appreciation of both arts.

There is, in addition, an analogy between the number of waves in both sound and colour, but is not this analogy like two railroad trains both travelling at the same rate of speed on parallel tracksin the same direction to the same place? The vibrations which affect the eye and those which affect the ear are conveyed to different parts of the brain and produce two distinct impressions, both of which are felt, it is true, almost simultaneously.

The writer makes bold to put forth the theory that it is impossible for the human mind to feel any two emotions at the same time. Perhaps from a pathological standpoint this is a new thought. The reader can himself try the experiment of looking at a picture while hearing music; he will see that it is impossible to hear the music and see the picture at the same moment. It may be only an infinitesimal fraction of a second's difference when the sound is heard and the picture seen. The space of time between these brain vibrations may be so infinitesimal that it is almost imperceptible. Many musicians insist on very little light being in the room when they play so that the mind can concentrate on the music.

Colour is a graphic art, music is not. The former is used to-day in all the graphic arts, but in none of the other arts as poetry or music, either vocal or instrumental. It is true that when we hear certain compositions we get sensations of colour, but as I have explained in Chapter XI, "Colour Psychology," this is simply a psychological suggestion or association of ideas in the same way that colour suggests certain ideas from early association with them.

With the present scales in music now used by the Occidental the writer is unable to make the vibrations of colour coincide. Perhaps, if some of the Oriental music scales were used it would be possible to make the two synchronize perfectly, and certain combinations of colour might give us the same sensation as certain combinations of sound. There are, I believe, different scales

at present founded on each degree in the diatonic scale. Perhaps some musician can find a scale which will coincide with this colour system.

As I have already said, colours must be combined in harmonies or contrasts to form a pleasing composition of colour, so one note of music and one colour only would hardly express a theme.

Regarding so-called colour music or an art of colour only it has already been said in the introduction that one can hardly call colour or a combination of colours alone high art. Coloured lights can be thrown on a screen in combinations or in succession, or pictures can be painted from which we derive a certain amount of elation, but if the colours express some form they will satisfy to a greater degree our æsthetic sense. It is not necessary to portray some known form of nature, for sometimes a fantastic shape or some flat design that resembles nothing we have ever seen before is very beautiful and satisfying, especially if the design is in good composition and form. Mineral oil thrown on water on the street has attracted many of us, times without number. So if we are to have a new art called Colour Art or Colour Music or Colour Poetry, let us not forget that colour is a plastic art and so must be expressed in plastic form.

Perhaps some day someone will be able to give us an art with the help of the moving picture machine or other movable lighting effect which will make us feel the height of emotion which is possible in music. Mr. A. Wallace Rimington has already succeeded in giving to us what he calls his "Colour Organ," which by the constant changing of colour on a screen gives us certainly a very pleasing sensation. This is done by means of a keyboard similar to, and played upon like, the piano. But the writer has found with numbers of experiments that the same colour does not give the same emotion to all people alike. In the chapter on "Colour Psychology" the reason has been explained for this divergence of feeling in regard to all colours. But, in addition to this, it has also been found that all eyes do not see colour in the same proportion. In certain eyes the green which is sensitive to the green light is more developed than in others; and then again the violet is more developed, and in others the red.

All things in nature are relative. By the law of relativity we know that there is no positive time or space. Things are measured, seen, or felt by the relationship of one thing to another. Colour or music is no exception to this law. If a red light is thrown on to a crimson, scarlet, red, orange, or yellow picture, and if no other rays of light are visible to the eye, the picture so painted will appear to be a perfectly white canvas. It is the same as if we draw

with red crayon on red paper. The retina of the eye is covered with red rays, and therefore no red sensations are possible while the red light enters the eye. This, of course, applies to all the other colours of the spectrum. If we have another coloured ray by which to compare this red we will immediately become conscious of the red reflections from the picture. It can be seen by this argument that it is necessary to have something with which to compare one colour with another. One note in music in itself has no beauty, but by the sequence of tones we can create harmonies or discords. So in colour, more than one tone or hue must be visible at the same time so that we can appreciate the relative sequence. I reiterate, colour is a graphic art. One colour wave after another thrown on a screen in flat masses would create no emotion, but if colours are thrown on a screen even in clouded masses or uneven forms with different colours showing at the same time we are able to feel a sensation which, perhaps, some day may be developed into a colour poem.

CHAPTER TWENTY-TWO: DICTIONARY OF COLOURS—THEIR PLACE IN THE SPECTRUM AND THEIR CHEMICAL COMPOSITIONS

HE following dictionary of colour has been compiled from knowledge gleaned from many sources, for ready reference. The chemical consistencies of each pigment have been compiled from the latest chemical researches and ancient data. The placing of the colours in their relative position on the Spectrum Chart has been done so that the artist or layman can understand how to mix them to get hues, tones, and tints; how to neutralize them with their complementary; to make colour combinations and their accepted psychological significance.

Many paints are named after the ancient colours which were not permanent which are now made permanent by using a different chemical, such as the madders, Indian yellow, lakes, etc.

I give here a suggestion for a permanent palette for the artist:

Zinc white or the new titanium whites which are approximately 25% titanium dioxide and 75% precipitated barium sulphate.
Alizarin crimson
Aureolin, barium yellow, zinc yellow, or pale cadium called daffodil
Émeraude green or veridian
Light ultramarine
Yellow ochre
French vermilion } (at times when a brilliant colour is desired)
Cobalt violet }

Black is made by the mixture of two complementaries only.

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DICTIONARY OF COLOURS

White

Its place in the spectrum and its complementary

Reflects all colours. If white light is decomposed it will separate into red, green, and violet rays.

History

In early times there were the following whites:

Flake White, which was made by the acid of grapes with lead.

White Lead, which was the rust of lead formed with vinegar.

Horn White, which was the earth calcined from horn.

Pearl White, which was the powder of pearl or fine parts of oyster shells.

Troy White, which was chalk neutralized by the addition of water in which alum was dissolved.

Eggshell White, which was powdered eggshells.

Chemical properties

The modern colourman makes the following:

Flake White, good for painting primer on canvas or painting ground. Foundation white, Cremnitz white, and flake white mixed with turpentine only are good for priming canvas or painting ground previous to painting on it as it gives a tooth on which subsequent painting will take hold.

New White is a mixture of zinc white and Cremnitz white. All mixtures of lead white and zinc white are more permanent than lead whites alone.

Silver White, French White, and Blanc d'Argent are all carbonates of lead. Less body than flake white but otherwise similar in their characteristics.

Zinc White, oxide of zinc. Present mode of manufacturing makes this a very pleasant white to handle. It has been improved upon within the last few years so that the working body is the same as lead white. It will mix with all pigments that are in themselves permanent and is much the safest white to use, unless some manufacturer will make a white of calcined horn, as the writer believes the ancients used.

Chinese White is another white that comes from zinc.

Permanent White or Baryta White, precipitated from sulphate of barium, is not satisfactory because of its lack of opacity.

Winton White, a combination of lead and zinc white, is permanent and very pleasant to work with.

Hamburg White is a mixture of two thirds barium sulphate and one third white lead. It is permanent but is apt to become transparent.

Cremnitz White is similar to flake white. Inferior in body though superior in whiteness.

Dutch White contains one fourth white lead and three fourths barium sulphate. It is permanent and good for priming canvas.

Permalba. This is a new white made by Weber & Company which is made approximately of 25% titanium dioxide and 75% precipitated barium sulphate.

White Lead, which is carbonate and hydrate of lead, is very much used by modern printers. It has a tendency to become yellow or brown with age or exposure to sulphur fumes. It undergoes a gradual loss of opacity. Not good to mix with many other

colours, such as vermilion, chrome, or cobalt. White lead is sometimes known as flake white.

Psychology

It is the symbol of purity and sacrifice to the Occidental; a sign of mourning to some Orientals, such as the Javanese and Koreans.

REDS

Vermilion or Cinnabar

Its place in the spectrum and its complementary

Reflects the red rays of the spectrum. There are slightly different hues, some more toward the orange, and others more toward the scarlet. Chinese vermilion is scarlet in hue; English vermilion has an orange hue; and French vermilion is the true red of the spectrum. It is claimed by the Chinese to be found in natural state. It can be imitated to a more or less brilliant degree by the mixture of crimson and yellow, or orange, chrome, and alizarin crimson, but no mixture of two colours can equal the brilliancy of vermilion itself. French vermilion is one of the primaries of the spectrum as near as the colourman has been able to make. Its complementary is blue.

History

It is a very ancient colour and was used by the sixteenth-century painters as a ground on which to glaze other colours. It has been used by the Chinese for centuries.

Chemical properties

If it is pure it is made of sulphide of mercury, which is sulphur and quicksilver. There is also black sulphide of mercury known as æthiope mineralis. Vermilion is a permanent colour; is not good to use in fired enamel because it is volatile. Not good to mix with white lead, as the sulphur and lead combined make a dark mud colour in time.

Psychology

It is the symbol of war, passion, danger, and courage.

Orange-Vermilion

Its place in the spectrum and its complementary

It is a bright red-orange very nearly the colour of orange in the Spectrum Chart. Mixtures can be made as with vermilion. Its complementary is a slightly violet-blue.

History

Same as vermilion.

Chemical properties

Same as vermilion.

Psychology

Is a symbol of glory, heat, laughter, harvest, and plenty, autumn, happiness, and warmth.

Field's Orange-Vermilion

Its place in the spectrum and its complementary

The same as orange-vermilion, a little more brilliant but not so opaque.

History
See vermilion.
Chemical properties
Same as vermilion.
Psychology
Same as vermilion.

Light Red

Its place in the spectrum and its complementary
It is a neutralized red and can be mixed with vermilion with a little blue and white, or crimson, yellow, blue, and white.
History
See Venetian red.
Chemical properties
It is an oxide of iron or ochrous earth, and is permanent.
Psychology
The same as red only in a milder degree on account of its neutralization.

Venetian Red, Terra Rosa, or Light Red

Its place in the spectrum and its complementary
It is a neutralized scarlet. Its complementary is blue-green. It can be mixed with crimson and yellow and neutralized with émeraude green.
History
A very ancient colour used for underpainting especially by the northern Italians in the sixteenth and seventeenth centuries. The picture was painted in monochrome of this colour. Perhaps this is the reason why some of these pictures get brown in later years, as the underground always works up to the surface.
Chemical properties
Venetian red is an oxide of iron; is permanent.
Psychology
Same as red.

Indian Red

Its place in the spectrum and its complementary
It is a neutralized scarlet and can be made from a mixture of alizarin crimson and a little yellow or vermilion and crimson, or crimson and orange—each combination being neutralized with blue-green. Its complementary is blue-green.
History
A very old pigment. See Venetian red.
Chemical properties
Indian red is an oxide of iron. It is very strong and will work through the other colours. It is permanent, but when used on the palette it modifies all colours.

Psychology
Same as scarlet.

Crimson Lake

Its place in the spectrum and its complementary
Is a crimson tending slightly toward purple. Its complementary is green tending slightly toward yellow-green.

History
It is an ancient colour but was found by the old masters to vary greatly in its value in regard to permanency, some standing well as a glaze, others made in the same way being fugitive.

Chemical properties
At present this colour is made with alizarin crimson instead of as was formerly done with cochineal bugs the same as carmine.

Psychology
Denotes beauty, glory, courteousness, and generosity.

Harrison Red

Its place in the spectrum, and its complementary
It is a scarlet. Its complementary is a blue-green.

History
This is a new combination of pigments, and its permanency is considered good, but as it has been used for a very few years, what it will be after being painted many years is impossible to tell.

Chemical properties
A semi-transparent lake colour of scarlet hue, made from a product of the modern dye industry. Unsafe in mixtures with certain metallic pigments and ochrous earths, as this colour dries exceptionally slowly, taking perhaps one, two, or three weeks to dry, and in the drying it throws off oil into other colours surrounding it, changing their colour by the addition of oil—therefore it is not recommended.

Psychology
Denotes blood, anger, beauty, glory.

Scarlet Lake

Its place in the spectrum, and its complementary
Is a modified crimson alizarin; semi-transparent. Its complementary is blue-green.

History
See alizarin crimson, of which it is now made.

Chemical properties
Less permanent than either of its components. Harrison red is now used for this colour, but it dries very poorly and takes about six weeks sometimes to dry.

Psychology
Denotes blood and anger.

Permanent Crimson or Alizarin Crimson

Its place in the spectrum and its complementary
Is the true crimson in the spectrum. Red light and violet light will produce crimson light. Its complementary is emerald green.
History
A modern discovery of Dr. Caro of Mannheim.
Chemical properties
Perfectly permanent under all conditions, it is very powerful, and for that reason many artists prefer the diluted colour such as the madders which are now made from alizarin. It is the only coal tar colour which is really permanent.
Psychology
It symbolizes beauty, glory, and generosity.

Madder Lakes and Alizarin Lakes

Their place in the spectrum and their complementary
They are crimson, slightly scarlet. Their complementary is émeraude green.
History
See alizarin crimson.
Chemical properties
The madder lakes are the most permanent of the rich red lakes. These pigments were obtained by precipitating colouring matter extracted from the root of the rubia Tinctorum plant on an aluminum or tin base, but now generally made from alizarin.
Psychology
Same as crimson.

Madder Carmine

Its place in the spectrum and its complementary
It is crimson; its complementary is green.
History
A very old dye. See Crimson Lake.
Chemical properties
Madder carmine is the richest of the lakes and is the only comparatively durable carmine if made with alizarin, but if made with the cochineal bug not so durable.
Psychology
Denotes bloodshed and anger.

Rose Madder

Its place in the spectrum and its complementary
It is a pale crimson, slightly scarlet. Its complementary is green, slightly blue-green.
Pink madder and madder lake are other names for rose madder.
History
See other Madders.

Chemical properties, whether permanent or not.
See other madders and alizarin crimson of which it is now made.
Psychology
Signifies anger and bloodshed.

YELLOWS

Yellow Ochre

Its place in the spectrum and its complementary
Is a neutralized yellow-orange. Its complementary is blue-violet, more violet than blue. Native and Roman ochre, burnt and brown ochres, transparent golden ochre are only fancy names for varieties of yellow ochre, the tints and methods of production varying slightly.
History
One of the oldest colours used.
Chemical properties
Yellow ochre is a native oxide of iron and is permanent. It can be mixed with yellow and orange, yellow and red, or yellow and crimson—each combination neutralized by blue-violet and white added. Native and Roman ochre, burnt and brown ochres, transparent golden ochre are all permanent oxides of iron. When the ochre is burnt and turns more red it becomes a neutralized orange or neutralized red and gets its psychological properties from the colour it most resembles.
Psychology
As it is more yellow than orange it signifies decay, deceit, indecency, inconsistency, and sickness. The orange gives a slight suggestion of plenty and harvest.

Raw Sienna

Its place in the spectrum and its complementary
Is a grayed-yellow-orange the same as yellow ochre. Its complementary is blue-violet, more violet than blue.
Chemical properties
It is ferrous hydroxide of iron and clay. It is permanent, and is nearly transparent, similar to golden ochre.
Psychology
Same as yellow ochre.

Burnt Sienna

Its place in the spectrum and its complementary
It is a neutralized red and can be mixed from crimson and yellow or vermilion neutralized by its complementary, blue.
Chemical properties
It is raw sienna calcined. This earth dries badly in oil and cracks if the picture is varnished too soon. As it can be mixed with the colours of the regular palette there is no use having it, especially as the artist is apt to use it in any and all kinds of mixtures, making the picture all "Brown Sauce."

Psychology
Symbolizes in a modified degree war, passion, danger, and courage.

Vandyke Brown

Its place in the spectrum and its complementary
It is a neutralized orange. Can be mixed with orange neutralized with its complementary, blue-violet.
History
A very old colour.
Chemical properties
It is a brown earth, but does not dry well; in fact, the writer believes it cracks very badly if varnished before the picture has been dry for a year or so.
Psychology
Same as orange only very weak in its effect because of its deep neutralization.

Cassel Brown

Their place in the spectrum and their complementary
Is a neutralized orange. Its complementary is blue-violet.
Chemical properties
An earth which differs from Vandyke brown only in tint and name.
Psychology
Same as Vandyke brown.

Indian Brown and Cologne Earth

Their place in the spectrum and their complementary
Are more neutralized than Vandyke brown. Complementary is blue-violet.
History
Ancient colours.
Chemical properties
Cologne earth is a fossil substance. Very good for making illustrations for reproductions as the camera photographs a deep rich shadow, and the high-lights look bluish when this colour is mixed with any white, especially zinc white.
Psychology
Same as Vandyke brown.

Cappagh Brown

Its place in the spectrum and its complementary
Is a neutralized orange made by the admixture of blue-violet and orange. Its complementary is blue-violet.
History
An ancient colour.
Chemical properties
It is a combination of oxides of iron and manganese; fairly permanent.

Psychology
Denotes warmth, plenty, contentment, and harvest.

Verona Brown

Its place in the spectrum and its complementary
Is a yellow-orange neutralized with violet-blue-violet. Its complementary is violet-blue-violet.

History
An old colour.

Chemical properties
Is obtained by calcining the native earth (terre verte); consists chiefly of magnesium silicate coloured with oxide of iron; fairly permanent.

Psychology
Being more orange than yellow it symbolizes warmth, plenty, and contentment in a lesser degree than Cappagh brown.

Raw Umber

Its place in the spectrum and its complementary
It is a yellow-orange more neutralized than Verona brown. Its complementary is violet-blue-violet.

History
A very old colour.

Chemical properties
It is a compound of iron and silicate, an ochrous earth. Permanent under all conditions. It has a good drying quality, better than other ochrous colours.

Psychology
Same as Verona brown.

Burnt Umber

Its place in the spectrum and its complementary
It is a neutralized orange a bit redder than Cappagh brown. Its complementary is blue-violet. It can be mixed with red and a little light ultramarine.

History
A very old pigment.

Chemical properties
It is the raw umber calcined.

Psychology
Signifies happiness, contentment, warmth, plenty, and harvest.

Caledonian Brown

Its place in the spectrum and its complementary
It is a neutralized reddish orange. Its complementary is blue-violet. Can be mixed with red and green.

Chemical properties
It is a useful colour, made by mixing two brown earths, and is therefore reliable.
Psychology
Signifies happiness, contentment, warmth, plenty, and harvest.

Bone Brown and Mummy Brown

Their place in the spectrum and their complementary
They are a highly neutralized orange. They are complementary to blue-violet. Can be mixed with orange and blue-violet.
History
Very old colours.
Chemical properties
They are of organic origin. The first is obtained by a particular calcination of bones, while the latter is actually the ground-up body of a mummy. Both are bad dries in oil, and not particularly desirable.
Psychology
Same as orange.

Brown Madder

Its place in the spectrum and its complementary
It is scarlet neutralized with blue-green. Its complementary is blue-green.
History
An ancient colour.
Chemical properties
Formerly made from the madder root. It has been proved to be impermanent by official trial. Can be made with alizarin crimson, barium yellow, and blue ultramarine, which would then be permanent.
Psychology
To a very limited extent it expresses rest and studiousness.

Brown-Pink

Its place in the spectrum and its complementary
It is a neutralized orange. Its complementary is blue-violet.
History
A comparatively modern colour.
Chemical properties
It is obtained from the quercus nigra (quercitron) bark. Not permanent.
Psychology
Symbolizes the same as orange.

Italian Pink

Its place in the spectrum and its complementary
It is an orange-yellow, not pink at all. Its complementary is a slightly blue-violet.

History
A comparatively modern colour.
Chemical properties
It is made of quercus nigra bark. Not permanent.
Psychology
Being more yellow than orange it symbolizes the psychological properties of yellow: cowardice, indecency, decay, deceit, inconsistency, and sickness.

Yellow Lake

Its place in the spectrum and its complementary
It is yellow with just a small amount of orange. Its complementary is violet.
History
A comparatively modern colour.
Chemical properties
It is a colour of vegetable extraction; not permanent.
Psychology
It has the psychological properties of yellow.

Asphaltum or Bitumen

Its place in the spectrum and its complementary
Its colour is a neutralized yellow-orange. It can be mixed with orange with a little yellow neutralized with blue-violet. A slightly violet-blue-violet is its complementary.
History
A very old paint, and the cause of much of the "Brown Sauce" of some of the old masters.
Chemical properties
It is a natural pitch, unchangeable in colour but affected by the temperature so that it runs on the canvas in warm weather.
Psychology
Same as orange.

Lemon Yellow or Barium or Zinc Yellow

Its place in the spectrum and its complementary
It is a pale yellow with a greenish tinge. It can be made from the mixture of chrome yellow, a very small amount of yellow-green, and white. Its complementary is violet with a very small amount of crimson added.
History
A comparatively modern colour.
Chemical properties
This colour when compounded from zinc yellow or barium salts is permanent. Also pale cadmium or daffodil yellow is, to all intents, permanent.
Psychology
Denotes cowardice, indecency, decay, deceit, inconsistency, and sickness.

Strontium Yellow

Its place in the spectrum and its complementary
Is slightly greened yellow with violet slightly purple for its complementary.
History
A modern colour.
Chemical properties
It is a chromate of strontium. It is more brilliant than but inferior in permanency to lemon-yellow.
Psychology
Same as yellow.

King's Yellow or Orpiment

Its place in the spectrum and its complementary
It is almost the true spectrum yellow in colour. Its complementary is violet.
History
A very ancient colour.
Chemical properties
It is made of sulphide of arsenic and is a deadly poison. It is not permanent.
Psychology
Symbolizes same as yellow.

Cadmium Yellow; pale or Daffodil Yellow

Its place in the spectrum and its complementary
It is yellow, very slightly orange. Its complementary is violet.
History
A modern colour.
Chemical properties
It is a sulphide of cadmium and because of the sulphur in its composition it is not permanent in mixtures that are affected by sulphur (lead chromes, white lead, etc.) Not reliable only on account of manufacturers not being careful in using an oil in which acid has been the bleaching agent. Also made by mixture of cadmium, middle, and chromate of zinc.
Psychology
Same as yellow.

Cadmium Yellow (middle)

Its place in the spectrum and its complementary
It is an orange-yellow. Its complementary is violet with a very small amount of blue-violet added.
History
A modern colour.
Chemical properties
It is sulphide of cadmium and is more orange than pale cadmium yellow. See pale cadmium.

Psychology
Same as yellow-orange.

Cadmium Orange (deep)

Its place in the spectrum and its complementary
It is a yellow-orange. Its complementary is violet, slightly more blue-violet on account of the orange tone. It will not make a brilliant green.

History
A modern colour.

Chemical properties
It is made of sulphide of cadmium. A permanent colour except in lead mixtures. See pale Cadmium.

Psychology
Tending more toward orange than toward yellow, it symbolizes warmth, laughter, and plenty.

Chrome Yellow (pale)

Its place in the spectrum and its complementary
It is yellow with a small amount of white. Its complementary is violet.

Chemical properties
It is a chromate of lead and other lead salts of a lemon hue; good covering power but not permanent. This pale chrome is not nearly as permanent as the deeper shades. In water colours it is too opaque for use with transparent colours.

Psychology
Denotes same as yellow.

Chrome Yellows, Middle and Deep, and Orange

Their place in the spectrum and their complementary
Are similar gradations to cadmium yellow. Their complementary is violet going toward blue-violet as the chromes deepen.

History
A comparatively modern colour.

Chemical properties
They are liable to be decomposed by chemical reactions occurring in mixtures, but when mixed with an oleoresinous medium (varnish) they will probably be permanent under all conditions. With the palette suggested in the first part of this chapter these chromes will stand indefinitely if a varnish medium is used.

Psychology
They denote the same as yellow for the chrome yellows, and as orange for the chrome oranges.

Aureolin

Its place in the spectrum and its complementary
It is a true yellow. Violet is its complementary.

Chemical properties
It is composed of the nitrates of cobalt and potassium. It is permanent, and safer than gamboge or Indian yellow.
Psychology
Denotes cowardice, indecency, decay, deceit, inconsistency, sickness, sunlight, and brightness.

Gamboge

Its place in the spectrum and its complementary
It is yellow with a touch of orange added. Its complementary is violet with a very small amount of blue-violet mixed with it.
History
A very ancient colour, formerly brought by camels from the East.
Chemical properties
It is a kind of resinous material better in water than in oils. Not permanent.
Psychology
Means, in a slightly modified degree, the same as yellow.

Indian Yellow

Its place in the spectrum and its complementary
It is very much like gamboge in colour and can be made from the addition of a small amount of orange to yellow. Its complementary is violet with a tinge of blue-violet.
History
Formerly known to the old masters as gallstone; it was made from bile of oxen.
Chemical properties
If made from animal excrement substances, as was formerly done, it is not permanent, but if made from bichromate of potassium it is fairly permanent.
Psychology
Same as yellow-orange.

Naples Yellow

Its place in the spectrum and its complementary
A light orange-yellow. Its complementary is violet with some blue-violet.
Chemical properties
Naples yellow in pure form is made of lead antimoniate, but as this is not permanent, a mixture of cadmium yellow and zinc white is invariably substituted. The colour can be made by a mixture of yellow, orange, and white.
Psychology
Same as yellow and orange.

GREENS

Emerald Green

Its place in the spectrum and its complementary
It is the lightest and most brilliant green. Its colour is nearly the true green of the spectrum. Crimson is its complementary.

History

It has been used for many centuries. The old Italian masters used it, but only in varnish painting, which protects it from the air; used in this way will change but very little if not mixed with any other colour.

Chemical properties

It is composed of arsenic, copper, and acetic acid. It is not permanent in mixtures.

Psychology

Denotes victory, contemplation, immortality, and faith.

Malachite Green

Its place in the spectrum and its complementary

It is a slightly neutralized green. Its complementary is crimson. It can be made with émeraude, a little yellow, and white.

History

Supposed to be, in the ancient times, ground stone called malachite.

Chemical properties

It is obtained from the mineral malachite.

Psychology

It denotes victory, faith, immortality, and contemplation.

Verdigris

Its place in the spectrum and its complementary

Its colour is green with a little yellow-green and white added. Its complementary is crimson with a bit of purple added.

History

A very ancient colour, but never found to be permanent.

Chemical properties

It is compounded from acetic acid and copper. It is fugitive and liable to change more than those greens first mentioned.

Psychology

Same as green.

Olive Green

Its place in the spectrum and its complementary

It is a colour between yellow and yellow-green neutralized a little. Its complementary is a colour between violet and purple.

Chemical properties

It is a mixture of yellow and blue pigments; dependable on its brilliancy as to what colours it is made of.

Psychology

So strongly yellow it partakes in a modified degree of the psychological meaning of yellow.

Olive Lake

Its place in the spectrum and its complementary

It is a neutralized yellow-green. Its complementary is purple.

History
See other lakes.
Chemical properties
It is a mixture of yellow and blue pigments and is not dependable.
Psychology
It symbolizes youth, cheerfulness, peace, faith, and springtime.

Chrome Green 1

Its place in the spectrum and its complementary
It is a yellow-green; purple is its complementary. It is used a great deal by house painters, and the colours that it makes in later years are sometimes interesting to give an antique effect.
History
A modern colour.
Chemical properties
It is a double precipitate of chrome yellow and Prussian blue, and on account of the impermanency of Prussian blue turns black in the course of years. For the artist this colour is not necessary, as the real chromium green, known as émeraude or veridian, takes its place, and is permanent.
Psychology
It symbolizes youth, cheerfulness, peace, and faith.

Chrome Green 2

Its place in the spectrum and its complementary
It is a trifle bluer than green. Its complementary is crimson with a touch of scarlet added.
Chemical properties
Same as Chrome Green 1.
Psychology
It signifies faith, immortality, and contemplation.

Chrome Green 3

Its place in the spectrum and its complementary
It is blue-green. Its complementary is scarlet.
Chemical properties
Same as Chrome Green 1.
Psychology
Denotes semi-mystery, song, poetry, and high thinking.

Green Oxide of Chromium, Émeraude

Its place in the spectrum and its complementary
It is a colour between green and blue-green, just a shade neutralized. Its complementary

lies between crimson and scarlet.

Chemical properties

Unalterable under all conditions; mixes well with white. It will stand the fiercest heat unchanged. It is a chromium oxide.

Psychology

Denotes faith, immortality, and contemplation; also mystery, poetry, and song.

Veronese Green or Viridian

Its place in the spectrum and its complementary

In France it is known as vert émeraude (émeraude green). It is a blue-green not quite as blue as Chrome Green 3. Its complementary is scarlet with a little of crimson.

History

A comparatively new colour to the artist's palette, mistaken by one noted chemist of artists' colours for the same as emerald green which is an entirely different thing; this colour has taken the place of green ultramarine.

Chemical Properties

It is a brilliant hydrated oxide of chromium. It is perfectly permanent and very useful, particularly to make a very near approach to the brilliancy of emerald green by mixing with zinc yellow and white.

Psychology

It symbolizes semi-mystery, song, poetry, and high thinking.

Terre Vert

Its place in the spectrum and its complementary

It is a neutralized green mixed with white. Its complementary is crimson.

History

A very ancient colour used in olden times as a body colour on which to glaze the more brilliant.

Chemical properties

It is a sober green earth or ochre, thoroughly permanent. It can be made with émeraude green with a little crimson and white.

Psychology

Signifies same as green in a minor tone.

BLUES

Prussian Blue

Its place in the spectrum and its complementary

It is a deep tone of blue. Its complementary is vermilion. Sometimes nearly green-blue, and at other times blue-violet.

History

Used in the sixteenth century and never considered permanent, but on account of the high price of ultramarine in those days it was substituted for that colour.

Chemical properties
It is a ferri ferro cyanide of iron. It is unsafe as it turns itself and other colours green. A very powerful colour, and if used for house decorating will turn quickly to all shades of blue and green, which gives a very beautiful antique look to shutters, doors, etc.
Psychology
Denotes coldness, spirituality, severity, mystery, and truth.

Chinese Blue

Its place in the spectrum and its complementary
Also called Antwerp blue. Chinese blue has a little blue-green mixed with it. Its complementary is vermilion with a small amount of scarlet.
History
A modern colour, which does not come from China.
Chemical properties
Same as Prussian blue. It is unsafe as it turns itself and other colours green. If mixed with lead white it turns a neutralized yellow-green; if mixed with blue-black, it turns brown in time.
Psychology
Denotes coldness, spirituality, severity, mystery, and truth.

Indigo

Its place in the spectrum and its complementary
It is a blue neutralized by vermilion. Vermilion is its complementary.
History
As a dye a very ancient colour.
Chemical properties
Indigo is a vegetable blue obtained by macerating the Indigofera plant in water. It fades under exposure to light.
Psychology
Same as Prussian blue.

Intense Blue

Its place in the spectrum and its complementary
It is a deeper toned variety of indigo blue.
History
Same as indigo.
Chemical properties
Same as indigo.
Psychology
Same as Prussian blue.

Cobalt Blue

Its place in the spectrum and its complementary
Its colour is the true blue. Its complementary is vermilion.

History
Used as an underpainting in the sixteenth century.

Chemical properties
Cobalt blue is a combination of a salt of the metal cobalt with alumina. It is thoroughly reliable, but is now imitated by light ultramarine mixed with white which is sold for a high price, whereas ultramarine is much cheaper. The so-called cobalt should be cheaper than ultramarine.

Psychology
Signifies coldness, spirituality, severity, mystery, and truth.

Azure Blue

Its place in the spectrum and its complementary
It is a lighter variety of cobalt blue.

History
Same as cobalt blue.

Chemical properties
Same as cobalt blue.

Psychology
Same as cobalt blue.

Smalt

Its place in the spectrum and its complementary
In colour it is blue-violet. Its complementary is yellow-orange.

History
A very ancient colour used to get a shiny surface by dusting on wet paint.

Chemical properties
Smalt is made from cobalt and is a vitreous compound. It is not considered permanent and is unpleasant to work with, but can be used for painting on glass if burnt in. It is not generally known, but ancient stained glass was sometimes made with this colour, and it was guarded by the Saxons from being carried out of the country.

Psychology
Same as ultramarine.

Cyanine or Leitch's Blue

Its place in the spectrum and its complementary
It is deep cobalt blue in colour, and its complementary is vermilion.

History
Modern colour.

Chemical properties
Cyanine or Leitch's blue is a mixture of cobalt and Prussian blues. The cobalt part alone is permanent.

Psychology
Signifies coldness, spirituality, serenity, mystery, and truth.

Ultramarine Blue

Its place in the spectrum and its complementary

In colour it is blue-violet, slightly more blue—although ultramarine blue can be made violet to blue-green. Its complementary is orange. The "light ultramarine" is a *true* blue, a deeper colour than cobalt, which can be made by the addition of white.

History

The genuine ultramarine has been used since ancient times, but in 1826 J. B. Guinet of Lyons succeeded in making it artificially.

Chemical properties

Genuine ultramarine blue is made of lapus lazuli by an elaborate process and is therefore costly, but to-day the ultramarine sold is made artificially, which is practically the same as the genuine, just as permanent, and almost as brilliant.

Psychology

It is supposed to signify the ocean.

French Ultramarine

Its place in the spectrum and its complementary

Permanent blue, new blue, French blue, and light ultramarine are shades of French ultramarine.

History

Same as ultramarine.

Chemical properties

It is, roughly, a combination of alumina, silica, soda, and sulphur.

Psychology

Same as ultramarine blue.

Ultramarine ash

Its place in the spectrum and its complementary

It is slightly neutralized blue-violet with white and a very small amount of orange. Its complementary is orange. Can be made with ultramarine blue mixed with orange and white.

History

An ancient colour.

Chemical properties

Ultramarine ash is supposed to be made from the refuse of genuine ultramarine. It is permanent.

Psychology

Same as ultramarine blue.

Coelin Blue or Cœruleum

Its place in the spectrum and its complementary

It is a colour between blue and blue-green with a complementary between vermilion and scarlet.

History
It is a very ancient colour and was used by the sixteenth-century painters as an underground on which they painted transparent blues.

Chemical properties
It is a combination of the oxides of cobalt and tin with silica. It is semi-opaque and permanent. At the present time much of the cœruleum is made of light ultramarine and zinc yellow.

Psychology
Same as blue.

Permanent Mauve

Its place in the spectrum and its complementary
It is a variety of French ultramarine. Its colour is violet. Yellow is its complementary. Permanent mauve, mineral violet, and permanent violet are all varieties of French ultramarine.

History
A modern colour.

Chemical properties
If this colour is made of ultramarine it is perfectly safe, but if made by the method of making mauve it is absolutely impermanent. The method of making ultramarine mauve is that when the ultramarine chemicals are heated they are allowed to cool very slowly—the more slowly they cool the more violet or purple will the result be.

Psychology
It signifies sadness, piety, sentimentality, royalty, and wealth.

Cobalt violet

Its place in the spectrum and its complementary
It is a purple colour, very brilliant, and has the power to show under artificial light a little more toward the crimson than in the daylight. Its complementary is yellow-green.

History
Has been known for about a hundred years.

Chemical properties
It is a chemical precipitate made with phosphate of cobalt. It has the same semi-transparency of cobalt blue and is not absolutely permanent unless locked up in a varnish medium.

Psychology
Denotes royalty, richness, and wealth.

Neutral Tint

Its place in the spectrum and its complementary
It is a highly neutralized blue-violet. Its complementary is highly neutralized orange.

Chemical properties
Neutral tint is a compound colour of no permanence. This colour can be made with a mixture of any two complementary colours and can be made permanent by this method.

The mixture of blue-violet with a little orange and white will give a perfect neutral and will be permanent.

Psychology

Denotes quietness, piety, and calmness.

GRAYS AND BLACKS

Payne's Gray

Its place in the spectrum and its complementary

It is a highly neutralized blue. Its complementary is red.

History

A modern colour.

Chemical properties

Payne's Gray in water colours is not permanent under exposure; but if made with light ultramarine blue and vermilion is permanent in oil.

Psychology

Denotes same as mineral gray.

Mineral Gray

Its place in the spectrum and its complementary

It is a neutralized blue. It can be made with light ultramarine, French vermilion, and white. Its complementary is red.

History

A modern colour, very expensive, but not at all necessary as it can be made as above.

Chemical properties

Mineral gray is made of the residue of lapis lazuli obtained from the making of ultramarine ash and gang rock. It is permanent. This is now made from the by-product in the making of an artificial ultramarine.

Psychology

Denotes coolness, calm, and quietness.

Lamp Black

Its place in the spectrum

In colour it is a bluish neutral, and can be made from blue and vermilion. If this colour is used on the artist's palette and mixed with red to make a dark red it will make a dark purple instead. If mixed with yellow to make dark yellow it will make a green instead. It is good for house painters to use this colour, as they can mix large quantities at one time and add other colours to get the desired hue, but it is not good to use as a universal medium of darkening all colours as it will change the hue besides the tone.

History

An ancient colour.

Chemical properties

Lamp black is the soot of resinous matter and consists chiefly of carbon. It is permanent but dries badly in oil.

Psychology
Sign of mourning to the Occidental; sorrow; despair.

Blue-Black

Its place in the spectrum
Its colour is a bluish neutral and can be reproduced from the mixture of blue and vermilion.

History
An ancient paint

Chemical properties
It is made from wood charcoal. It is permanent but a bad drier in oil.

Psychology
Same as ivory black.

Ivory Black

Its place in the spectrum
In colour it is a neutral made from blue and vermilion. It is perhaps the blackest of all of the blacks, especially in a north or blue-white light, but in a warm light it is not so dark.

History
It is a very ancient colour, and in the sixteenth century it was made in a blue-black colour.

Chemical properties
Ivory black is calcined ivory, ground, and mixed as a paint. It is permanent but dries very slowly in oil. The writer believes this is the cause of cracking in many pictures.

Psychology
Denotes sorrow, death, and despair.

Black Lead

Its place in the spectrum
It is a dark neutral having a somewhat metallic surface.

History
An ancient colour.

Chemical properties
Black lead is a permanent pigment of a dull black hue. It is manufactured from carbon in the form of graphite. So-called lead pencils are black lead. Is found in native state.

Psychology
Same as ivory black.

EXERCISES IN COLOUR

Exercises have been planned with the object of teaching this system of colour perception and execution. The lessons are so arranged that by progressive exercises the student is able to adapt the knowledge gained for use in portrait painting, figure painting, landscape painting, interior decoration, costume design, poster, batik, stage design, textiles, and other arts.

These exercises also teach the student something of design which is so important to modern portrait and landscape painters.

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